REFERENCES

Adams, D. A., Richardson, G. J., Ryman, B. E., and Wisniewski, H. M. 1977. Liposome toxicity in mouse central nervous system. J. Neurol. Sci. 31: 173-179.

Arias, C., and Rueda, C. 1992. Comparative study of lipid systems from various sources by rotational viscometry and potentiometry. Drug Dev. Ind. Pharm. 18: 1773-1786.

Bach, A. C., Ferezou, J., and Frey, A. 1996. Phospholipid-rich particles in commercial parenteral fat emulsions. An Overview. Prog. Lipid Res. 35: 133-153.

Bangham, A. D. 1968. Membrane models with phospholipids. Prog. Biophys. Mol. Biol. 18: 29-98.

Beirbaum, T. J., Bouma, S. R., and Huestis, W. H. 1979. Mechanism of erythrocyte lysis by lyso phosphatidylcholine. Biochem. Biophys. Acta. 555: 102-110.

Benita, S., and Levy, M. Y. 1993. Submicron emulsions as colloidal drug carriers for intravenous administration: Comprehensive pharmacochemical characterization. J. Pharm. Sci. 82, 11: 1069-1079.

Bock, T., Kleinebudde, P., and MÜller, B. W. 1998. Manufacturing of emulsions by means of high pressure homogenization: influence of homogenization parameters, oils and surfactants. In R. H. Müller, S. Benita, and B. H. L. Böhm (eds.), Emulsions and nanosuspensions for the formulation of poorly soluble drugs. pp. 201-236. Stuttgart: Medpharm scientific.

British Pharmacopoeia, Vol. 2, 1980. London: H. M. Stationary Office.

Brown, R., Quercia, R. A., and Sigman, R. 1986. Total nutrient admixture: A review. JPEN. 10, 6: 650-658.

Buchheim, W. 1982. Aspects of sample preparation for freeze-fracture/ freeze-etch studies of proteins and lipids in food systems. Food Microstructure 1: 189-208.

Buszello, K. and Muller, B. W. 2000. Emulsions as drug delivery systems. In F. Nielloud and G. Marti-Mestres (eds.), Pharmaceutical emulsions and suspensions, pp.203-224. North Carolina: AAI.

Campbell, I. P. 1983. Toxicity of some charged lipids used in liposome preparations. Cytobios 37: 21-26.

ต้นฉบับ หน้าขาดหาย

Carstensen, H., Müller, B. W., and Müller, R. H. 1991. Characterization of the properties of parenteral fat emulsions related to their uptake by the RES. Proc. 18 th Int. Symp. Contr. Rel. Bioact. Mat. Amsterdam: 473-474.

Chanana, G. D., and Sheth, B. B. 1993. Particle size reduction of emulsions by formulation design 1: Effect of polyhydroxy alcohols. J. Parenter. Sci. Technol. 47: 130-134.

Chansiri, G., Lyons, T. R., Patel, V. M., and Hem, L. S. 1999. Effect of surface charge on the stability of oil/water emulsions during steam sterilization. Journal of Pharmaceutical Sciences 88, 4: 454-458.

Chaturvedi, P. R., Patel, N. M., Lodhi, S. A. 1992. Effect of terminal heat sterilization on the stability of phospholipid-stabilized submicron emulsion. Acta. Pharm. Nord. 4: 51-55.

Collins-Gold, L., Feichtinger, N., and Wärnheim, T. 2000. Are lipid emulsions the drug delivery solution? Modern Drug Discovery 3, 3: 44-46.

Collins-Gold, L. C., Lyons, R. T., and Bartholow, L. C. 1990. Parenteral emulsions for drug delivery. Adv. Drug Deliv. Rev. 5: 189-208.

Dardel, O. v., Mebius, C., and Mossberg, T. 1976. Diazepam in emulsion form for i.v. usage. Acta. Anaesth. Scand. 20: 221-224.

Davis, S. S. 1974. Pharmaceutical aspects of i.v. fat emulsions. J. Hosp. Pharm. 32: 149-170.

Davis, S. S. 1982. The stability of fat emulsions for intravenous administration. In I. D Johnston (ed.), Current perspectives in the use of lipid emulsion. pp. 35-61. U.K.: MTP.

Davis, S. S., Hadgraft, J., and Palin, K. J. 1985. Medical and pharmaceutical applications of emulsions. In P. Becher (ed.), Encyclopedia of emulsion technology vol. 2, pp.159-238. New York: Mercel Dekker.

Davis, S. S., and Hansrani, P. K. 1985. The influence of emulsifying agents on the phargocytosis of lipid emulsions by macrophages. Int. J. Pharm. 23: 69

Davis, S. S., Illum, L., Washington, C., and Harper, G. 1992. Studies on the interaction of charge-reversed emulsions with the reticuloendothelial system. Int. J. Pharm. 82: 99-105.

Davis, S. S., Washington, C., West, P., Illum, L., Liversidge, G., Sternson, L., and Kirsh, R. 1987. Lipid emulsions as drug delivery systems. Ann. N.Y. Acad. Sci. 507: 75-88.

DiLuzio, N. R., and Riggi, S. J. 1964. The development of a lipid emulsion for the measurement of reticuloendothelial function. J. Reticuloendothelial Soc. 1: 136-149.

Du Plessis, J., Tiedt, L. R., van Wyk, C. J., and Ackermann, C. 1986. A new transmission electron microscope method for the determination of particle size in parenteral fat emulsion. Int. J. Pharm. 34: 173-174.

El-Sayed, A. A. A., and Repta, A. J. 1983. Solubilization and stabilization of an investigational antineoplastic drug (NSC No. 278214) in an intravenous formulation using an emulsion vehicle. Int. J. Pharm. 13: 303.

Everett, D. H (ed.). 1988. Basic principles of colloid science: Royal society of chemistry. London: Burlington House.

Friberg, S., and Jansson, P. O. 1976. Surfactant association structure and emulsion stability. J. Colloid. Interf. Sci. 55: 614-623.

Froster, D., Washington, C., and Davis, S. S. 1988. Toxicity of solubilized and colloidal amphotericin B formulations to human erythrocytes. J. Pharm. Pharmacol. 40: 325-328.

Georges, J and Chen, J. W. 1986. Microemulsion studies: Correlation between viscosity, electrical conductivity and electrochemical and fluorescent probe measurements. Colloid polyrn. Sci. 264: 896-902.

Geyer, R. P., 1967. Pareneteral nutrition. Bull. Parent. Drug Assoc. 21: 215-225.

Gould, L. A., Lansley, A. B., Brown, M. B., Forben, B., and Martin, G. P. 2000. Mitigation of surfactant erythrocyte toxicity by egg phosphatidylcholine. J. Pharm. Pharmacol. 52: 1203-1209.

Gregoriadis, G., and Neerunjum, D. E. 1974. Control of the rate of hepatic uptake and metabolism of liposome-entrapped proteins injected into rates. Biochem. J. 129: 123-133.

Groves, M. J. 1984. The application of particle characterization methods to submicron dispersions and emulsion. In H. G. Barth (ed.), Modern methods of particle size analysis. pp. 43-91. New York: Wiley.

Groves, M. J., and Herman, C. J. 1992. The redistribution of bulk aqueous phase phospholipids during thermal stressing of phospholipid-stabilized emulsion. J. Pharm. Pharmacol. 45: 592-596.

Groves, M. J., Wineberg, M., and Brian, A. P. R. 1985. The presence of liposome material in phospholipid stabilized emulsions. J. Dispersion Sci. Technol. 6: 237-243.

Guest, D and Langevin, D. 1986. Light-scattering study of a multiphase microemulsion system. J.

Colloid Interf. 112: 208-220.

Hashida, M., Egawa, M., Muranishi, S., and Sezaki, H. 1977. Role of intramuscular administration of water-in-oil emulsions as a method for increasing the delivery of anticancer agents to regional lymphatics. J. Pharmacokin. Biopharm. 5: 241.

Haumout, D., Deckelbaum, R. J., Richelle, M., Dahaln, W., Coussaert, E., Bihain, B. E., and Carpentier, Y. A. 1989. Plasma lipid and plasma lipoprotein concentrations in low birth weight infants given parenteral nutrition with twenty or ten percent lipid emulsion. J. Pediatr. 115: 787-793.

Herman, C. J., and Groves, M. J. 1993. Influence of free fatty acid formation on the pH of phospholipid-stabilized triglyceride emulsions. Pharm. Res. 10: 774-776.

Hoffmann, H., Platz, G., and Ulbricht, W. 1986. From micellar solutions to microemulsions: A kinetic study. Ber. Bunsenges. Phys. Chem. 90: 877-887.

Idson, B. 1988. Disperse systems. In H. A. Lieberman, M. M. Reiger, and G. S. Banker (eds.), Pharmaceutical dosage forms: Disperse systems vol.1, pp. 199-243. New York: Mercel Dekker.

International Union of Pure and Applied Chemistry. 1972. International Union of Pure and Applied Chemistry: Manual on colloid and surface science. Boston: Butterworth.

Jeppsson, R. I. 1972. Effect of barbituric acids using an emulsion form intraperitoneally and subcutaneously. Acta. Pharm. Suecica. 9: 199.

Jeppsson, R. I. 1975. Comparison of pharmacological effects of some local anaesthetic agents when using water and lipid emulsion as injection vehicles. Acta. Pharmacol. Toxicol. 36: 299.

Jeppsson, R. I., Groves, M. J., and Yalabik, H. S. 1976. The particle size distribution of emulsions containing diazepam for i.v. use. J. Clin. Pharm. 1: 123-127.

Jeppsson, R. I., and Ljunberg, S. 1975. Anticonvulsant activity in mice of diazepam in an emulsion formulation for i.v. administration. Acta. Pharmacol. Toxicol. 36: 312.

Jumaa, M., and Müller, B. W. 1998. The effect of oil components and homogenization conditions on the physicochemical properties and stability of parenteral fat emulsions. Int. J. Pharm. 163: 81-89.

Jumaa, M., and Müller, B. W. 2000. Lipid emulsions as a novel system to reduce the hemolytic

activity of lytic agents: mechanism of the protective effect. Eur. J. Pharm. Sci. 9: 285-290.

Kan, P., Chen, Z. B., Kung, R. Y., Lee, C. J., and Chu, I. M. 1999. Study on the formulation of o/w emulsion as carriers for lipophilic drugs. Colloids and Surfaces: Biointerfaces 15: 117-125.

Kahlweit, M., Strey, R., Haase, D., Kunieda, K., Schmeling, T., Faulhaber, B., Borkovec, M., Eicke, H. F., Busse, G., Eggers, F., Funck, T., Richmann, H., Magid, L., Söderman, O., Stilbs, P., Winkler, J., Dittrich, A., and Jahn, W. 1987. How to study microemulsions. J. Coloid Interf. Sci. 118: 436-453.

Kimelberg, H. K. 1980. Liposomes as carriers for methotrexate. In G. Gregoriadis, A. C. Allison (eds.), Liposomes in biological systems. pp. 219-246. USA: John Wiley

Klang, S. H., Frucht-Pery, J., Hoffman, A., and Benita, S. 1994. Physicochemical characterization and acute toxicity evaluation of a positively-charged submicron emulsion vehicle. J. Pharm. Pharmacol. 46: 986-993.

Korner, D., Benita, S., Albrecht, G., and Baszkin, A. 1994. Surface properties of mixed phospholipid-stearylamine monolayers and their interaction with a nonionic surfactant (poloxamer). Colloids and Surfaces: Biointerfaces. In Press.

Lawrence, M. J. 1994. Surfactant systems: Their use in drug delivery. Chemical Society Reviews : 417-424.

Lawrence, M. J. 2000. Emulsion [Slide]. King's College: Pharmaceutical Technology (International) Program.

Levy, M. Y., and Benita, S. 1989. Design and characterization of a submicronized o/w emulsion of diazepam for parenteral use. Int. J. Pharm. 54: 103-112.

Levy, M. Y., and Benita, S. 1990. Drug release from submicronized o/w emulsions: A new in vitro kinetic evaluation model. Int. J. Pharm.66: 29-371.

Levy, M. Y., Benita, S., and Baszkin, A. 1991. Interactions of a nonionic surfactant with mixed phospholipid-oleic acid monolayers: Studies under dynamic conditions. Colloids Surf. 59: 225-241.

Levy, M. Y., Langerman, L., Gottschalk-Sabag, S., and Benita, S. 1989. Side-effect evaluation of a new diazepam formulation: Venous sequela reduction following i.v. injection of a diazepam emulsion in rabbits. Pharm. Res. 6: 510-516.

Lidgate, D. M., Fu, R. C., Byars, N. E., Foster, L. C., and Fleitman, J. S. 1989. Formulation of vaccine adjuvant muramyldipeptides: Processing optimization, characterization, and bioactivity of an emulsion vehicle. Pharm. Res. 6: 748-752.

Lidgate, D. M., Trattner, T., Shultz, R. M., and Maskiewicz, R. 1992. Sterile filtration of a parenteral emulsion. Pharm. Res. 9: 860-863.

Lindman, B., Stilbs, P., and Moseley, M. E. 1981. Fourier transform NMR self-diffusion and microemulsion structure. J. Colloid Interf. Sci. 83: 569-582.

Lucks, J. S., Müller, B. W., and Klütsch, K. 2000. Parenteral fat emulsions: Structure, stability, and applications. In F. Nielloud and G. Marti-Mestres (eds.), Pharmaceutical emulsions and suspensions, pp. 230-257. North Carolina: AAI.

Lund, W., ed. 1994. The Pharmaceutical Codex: Principles and practice of pharmaceutics, 12th ed., pp. 82-101. London: The Pharmaceutical Press.

Magee, W. E., and Miller, O. V. 1972. Liposomes containing antiviral antibody can protect cells from virus infection. Nature 235: 339-340.

Mayhew, E., Ito, M., and Lazo, R. 1987. Toxicity of non-drug containing liposomes for cultured human cells. Exp. Cell Res. 171: 195-202.

Mehta, R. C., Head, L. F., Hazrati, A. M., Parr, M., Rapp, R. P., and DeLuca, P. P. 1992. Fat emulsion particle-size distribution in total nutrient admixtures. Am. J. Hosp. Pharm. 49: 2749-2755.

Messing, B., Peynet, J., Poupon, J., Pfeiffer, A., Thuillier, F., Chazouilleres, O., and Legrand, A. 1990. Effect of fat emulsion phospholipids on serum lipoprotein profile during 1 month of cyclic total parenteral nutrition. Am. J. Clin. Nutr. 52: 1094-1100.

Mizushima, Y. 1985. Lipid microspheres as novel drug carriers. Drugs Exp. Clin. Res. 11: 595-600.

Mizushima, Y. 1988. Application of lipid microspheres for targeting therapy. J. Bioact. Compat. Polym. 3: 148-156.

Mizushima, Y. 1990. Lipid microspheres for targeting therapy. Proc. 17th Int. Symp. Cont. Rel. Bioact. Mat., pp. 8-9.

Muchtar, S., Levy, M. Y., Sarig, S., and Benita, S. 1991. Stability assessment of a fat emulsion prepared with an original mixture of purified phospholipids. STP Pharma Sci. 1: 130-136.

Muller, B. W., and Muller, R. H. 1984. Particle size distribution and particle size alterations in microemulsions. J. Pharm. Sci. 73: 919.

Nema, S., Washkuhn, R. J., and Brendel, R. J. 1997. Excipients and their use in injectable products. PDA J. Pharm. Sci. Technol. 51, 4: 166-167.

Othmer, K. 1995. Lecithin. Encyclopedia of Chemical Technology. Vol. 15, 4th ed., New York: John Wiley & Sons.

Panaggio, A., Rodes, C. T., and Worthen, I. R. 1979. The possible use of autoclaving microemulsions for sterilization. Drug Dev. Ind. Pharm. 5: 169-173.

Philippot, J. R., and Schuber, F., eds. 1983. Liposomes as tools in basic research and industry: Influence of liposome characteristics on their properties and fate. Florida: CRC.

Phillies, G. D. 1990. Quasielastic light scattering? Anal. Chem. 62 (20): 1049A-1057A.

Pongcharoenkiat, N. 2001. *In vitro* activity and toxicity of amphotericin B triglyceride emulsion Versus Fungizone. Bangkok: The Government Pharmaceutical Organization (Unpublished Manuscript)

Poste, G., and Kirsh. R. 1983. Site-specific (targeted) drug delivery in cancer therapy. Bio Technolgy 1: 869.

Reich, I., Poon, C. Y., and Sugita, E. T. 2000. Tonicity, osmoticity, osmolality, and osmolarity. In Alfonso R. Gennaro (ed.), Remington: The science and practice of pharmacy. (20th ed.), pp. 246-255. USA: Philadelphia College of Pharmacy and Science.

Rosoff, M. 1988. Specialized pharmaceutical emulsions. In H. A. Lieberman; M. M. Rieger; and G. S. Banker (eds.), Pharmaceutical dosage forms: Disperse system Vol. 3, pp. 1-5. New York: Marcel Dekker.

Rotenberg, M., Rubin, M., Bor, A, Meyuhas, D., Talmon, Y., and Lichtenberg, D. 1982. Physicochemical characterization of Intralipid™ emulsions. Biochim. Biophys. Acta. 1086: 265-272.

Ruangthurakit, S. 2000. Development of lipid emulsion for parenteral nutrition. Master's Thesis, Department of Food Chemistry Faculty of Pharmaceutical Sciences, Chulalongkorn University.

Rubino, J. T. 1990. The influence of charged lipids on the flocculation and coalescence of oil-in-water emulsion 1: Kinetic assessment of emulsion stability. J. Parenter. Sci. Technol. 44:

210-215.

Rubino, J. T. 1990. The influence of charged lipids on the flocculation and coalescence of oil-in-water emulsion 2: Electrophoretic properties and monolayer film studies. J. Parenter. Sci. Technol. 44: 247-252.

Ruckenstein, E. 1986. The surface of tension, the natural radius, and the interfacial tension in the thermodynamics of microemulsions. J. Colloid Interface Sci. 114: 173-179.

Ryghag, L., and Wilton, I. 1981. The function of phospholipids of soybean lecithin in emulsions. J. Am. Oil Chem. Soc. 35: 830-837.

Saba, T. M. 1970. Physiology and physiopathology of the reticuloendothelial system. Arch. Intern. Med. 126: 1031.

Salager, J. L. 2000. Emulsion properties and related know-how to attain them. In F. Nielloud and G. Marti-Mestres (eds.), Pharmaceutical emulsion and suspensions. pp. 76-80. North Carolina: AAI.

Schuberth, O., and Wretlind, A. 1961. Intravenous infusion of fat emulsions, phosphatides and emulsifying agents. Acta. Chir. Scand. Suppl. 278: 1-21.

Sforzini, A., Bersani, G., Stancari, A., Grossi, G., Bonoli, A., and Ceschel, G. C. 2001. Analysis of all-in-one parenteral nutrition admixtures by liquid chromatography and laser diffraction: Study of stability. Journal of Pharmaceutical and Biomedical Analysis 24: 1099-1109.

Shchipunov, Y. A., and Kolpakov, A. F. 1993. Unusual processes of phospholipid dispersion formulation by the action of an external electric filed. Colloids Surfaces 76: 15-22.

Shils, M., Olson, J. A., and Shike, M. 1994. Modern nutrition in health and disease. pp. 842-860. Philadelphia: Lea & Febiger.

Simons, P. J., Cockshott, L. D., Douglas, E. J., Gordon, E. A., Hopkins, K., and Rowland, M. 1988. Disposition in male volunteers of a subanaesthetic intravenous dose of an oil in water emulsion of ^{14}C Propofol. Xenobiolica. 18: 429-440.

Singh, M., and Ravin L. J. 1986. Parenteral emulsions as drug carrier systems. J. Parent. Sci. Tech. vol. 40 no. 1: 34-41.

Stossel, T. P., Mason, R. J., Hartwig, J., and Vaughan, M. 1972. Quantitative studies of phagocytosis by polymorphonuclear leucocytes: use of emulsions to measure the initial

rate of phagocytosis. J. Clin. Invest. 51: 615.

Swarbrick, J., and Boylan, J. C. 1992. In P. Becher (ed.), Encyclopedia of Pharmaceutical Technology. pp. 137-187. New York: Marcel Dekker, Inc.

Takamura, A., Ishii, F., Noro, S., and Koishi, M. 1983. Effect of homogenization conditions on the physicochemical properties of emulsion bases. Chem. Pharm. Bull. 31: 2786-2792.

United States Pharmacopoeia. 1995. United States Pharmacopoeia. 23rd ed., Rockville: United States Pharmacopoeial Convention

Van Niekerk, P. J. 1988. Determination of vitamins. In R. Macrae (ed.), HPLC in food analysis. pp. 188-205. London: Academic Press.

von Dardel, O., Mebius, C., Mossberg, T., and Svenson, B. 1983. Fat emulsion as a vehicle for diazepam: A study of 9492 patients. Br. J. Anaesth. 55: 41.

Wade, A. and Weller, P. J. eds. 1994. Hand book of pharmaceutical excipients. 2nd ed. London: The Pharmaceutical Press.

Washington, C., Chawla, A., Christy, N., and Davis, S. S. 1989. The electrokinetic properties of phospholipid-stabilized fat emulsions. Int. J. Pharm. 54: 191-197.

Washington, C., and Davis, S. S. 1987. Aging effects in parenteral fat emulsions: The role of fatty acids. Int. J. Pharm. 39: 33-37.

Weiner, N. 2000a. Emulsion. Bangkok: Pharmaceutical Technology (International) Program (Mineographed)

Weiner, N. 2000b. Liposomes: Potential for commercial application. Bangkok: Pharmaceutical Technology (International) Program (Mineographed)

Weingarten, C., Nereide, S., Santos-Magalhaes, N. S., Baszkin, A., Benita, S., and Seiller, M. 1991. Interaction of a nonionic ABA copolymer surfactant with phospholipid monolayers: Possible relevance to emulsion stabilization. Int. J. Pharm. 75: 171-179.

Westesen, K., and Wehler, T. 1992. Physicochemical characterization of a model intravenous oil-in-water emulsion. J. Pharm. Sci. 81, 8: 777-786.

Winsnes, M., Jeppsson, R. I., and Sjöberg, B. 1981. Diazepam absorption to infusion sets and plastic syrings. Acta Anaesth. Scand. 25: 93-96.

Wretlind, A. 1976. Fat emulsions in parenteral nutrition. In H. C. Meng and D. W. Wilmore (eds.), American Medical Association, p. 109. USA: American Medical Association.

Yamaguchi, T., Nishizaki, K., Itai, S, Hayashi, H., and Ohshima, H. 1995. Physicochemical characterization of parenteral lipid emulsion: Influence of cosurfactants on flocculation and coalescence. Pharm. Res. 12: 1273-1278.

Yeadon, D. A., Goldblatt, L. A., and Altschul, A. M. 1958. Lecithin in oil/water emulsions. J. Am. Oil Chem. Soc. 35: 435-438.

APPENDICES

APPENDIX A

VALIDATION OF THE HPLC ANALYSIS

The vitamin analysis of vitamin A palmitate, vitamin D_3, vitamin E acetate and vitamin K_1 used in this study were all validated. The approximately the same results were found in all vitamins. The data below showed the validation of vitamin D_3. The parameters evaluated to ensure the acceptability of the performance of the selected analytical method were linearity, accuracy, precision, specificity and linearity (Van Niekerk, 1988).

1. Linearity

Under the assay conditions, the technique presented a true liner response to mean its ability to obtain results linearly in proportion to the concentration of analyte in the sample within a determined time.

The linearity of the method was proven by preparing a primary solution with approximately 1 mg/ml. The different strengths of dilution were made with propanol. Triple-analyzed and regression line were calculated as called the coefficient of variation of the response factors (f) which indicated the relation between reading and concentration. These two values should similar to each other and close to the value of the slope. If the value greater than 5%, it indicated a lack of linearity (Figure a1).

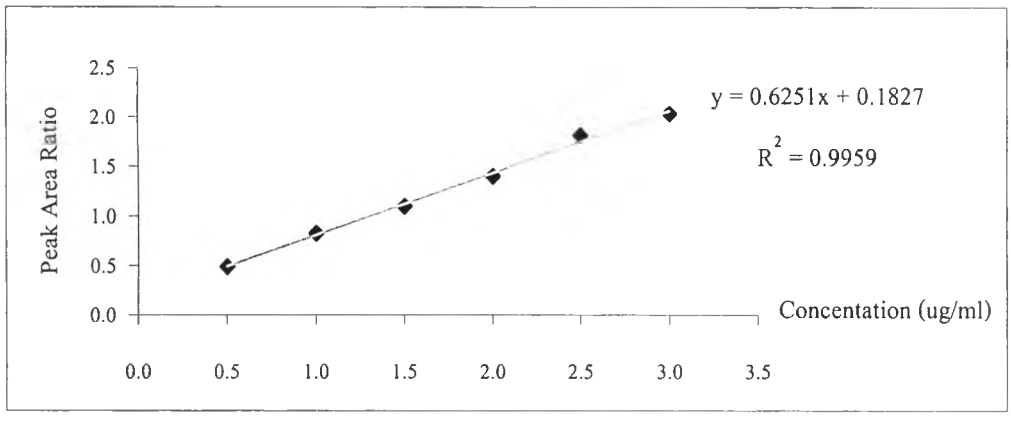

Figure a1. Calibration curve of standard vitamin D_3

2. Accuracy

Accuracy is an estimation of the variability of the measurements between individual results obtained from a homogeneous sample. It was determined from the values obtained in the linearity assay. Coefficients of variation lower than 2-3% was considered as acceptable.

$$\text{Accuracy (CV \%)} = \frac{SD}{X} * 100$$

Where

SD = Standard deviation of samples for each concentration

X = Mean experimental condition

3. Precision

Precision represents the degree of concordance between the results obtained in the analysis and the true value. It was determined for each standard solution from the 6 readings obtained in the replicability and reproducibility assays.

$$\% \text{ Relative error} = \frac{\text{Mean value} - \text{Read value} * 100}{\text{Real value}}$$

4. Specificity

Under the condition of experiment, the peaks of other components must not interfere with the peak of the drug. This validation was made by comparing the chromatograms between the based emulsion without the addition of vitamins and emulsion containing vitamins.

Figure a2.

Table a1. Accuracy data of analytical concentration

Expected concentration (μg/ml)	Analytical concentration (μg/ml)			% Remaining			Mean	SD	%CV
	1	2	3	1	2	3			
1.0	0.47	0.50	0.49	92	102	98	97.33	5.03	5.17
1.5	0.83	0.84	0.83	104	105	104	104.33	0.58	0.55
2.0	1.07	1.11	1.11	94.67	98	98	96.89	1.92	1.98
2.5	1.42	1.39	1.39	99	96.5	96.5	97.33	1.44	1.48
3.0	1.83	1.80	1.79	105.60	103.60	102.80	104.00	1.44	1.39

1, 2, 3 = number of determination

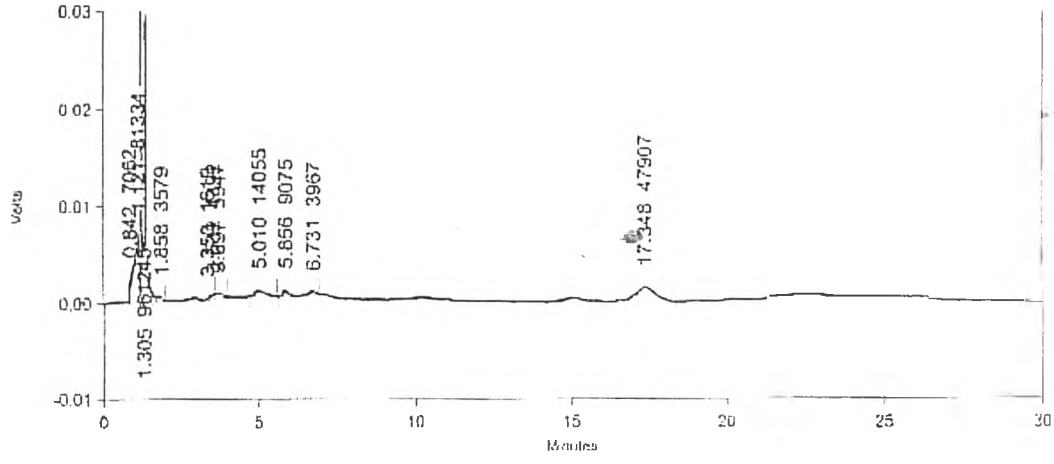

Figure a2. Chromatogram of based emulsion without incorporated vitamins

APPENDIX B

Detail of phospholipids

Table b1. Composition (%w/w) of egg/soy phospholipids used in formulations

Chemical composition	Amount (%w/w)	
	Soy phospholipids	Egg phospholipids
Phosphatidylcholine	min. 92.0	mt. 98.0
Lyso- phosphatidylcholine	max. 3.0	nmt. 0.2
Other phospholipids	max. 2.0	nmt. 1.1
α-tocopherol	0.2	0.1-0.2
Fatty acids (total content)	2.0	nmt. 0.2
Including:		
Saturated fatty acids	13-17	44-51
Monounsaturated fatty acids	6-8	30-35
Polyunsaturated fatty acids	75-81	16-21
of which:		
Linoleic acid	68-72	14-16
Linolenic acids	7-9	-

APPENDIX C

COMMERCIAL PRODUCTS FOR PARENTERAL NUTRITION

Table c1. Composition of Intralipid® containing 10% or 20% soybean oil

Composition	Intralipid® 10%	Intralipid® 20%
Fractionated soybean oil	100 g	200 g.
Egg-yolk phospholipid	12 g	12 g
Glycerol	22.0 g	22.0 g
Water for injection to	1 liter	1 liter
Total energy/L	1100 kcal	2000 kcal
Osmolality (mOsm/Kg water)	300	350
pH (approximate)	8.0	8.0
Dosage form	100, 500 ml	100, 250, 500 ml

Table c2. Formulation composition of oil-soluble vitamins for parenteral use

Composition	OMVI® (formulation 2), 4 ml	Vitalipid® N Adult, 10 ml
Vitamin A	3300 IU	3300 IU
Ergocalciferol (D_2)	-	200 IU
Cholecalciferol (D_3)	200 IU	-
Tocopherol acetate (E)	10 mg	10 mg
Phytonadione (K_1)	2 mg	0.15 mg
Polysorbate 80	70 mg	-
Polysorbate 20	8 mg	-
D-sorbitol	160 mg	-
Macrogol 400	80 mg	-

OMVI®, formulation 2 is formulated in aqueous solution (formulation 1 is lyophilized powder of water-soluble vitamins).

Vitalipid® N Adult is formulated in o/w emulsion dosage form using 1.2% egg phospholipids, 10% soybean oil and 2.5% glycerol..

Table c3. Particle size of 10% and 20% commercial lipid emulsion and o/w emulsion containing oil-soluble vitamins

Commercial product	Particle size of oil droplet (μm)						Figure
	D(0.5)			D[4,3]			
	1	2	3	1	2	3	
Intralipid® 10%	0.259	0.258	0.270	0.297	0.299	0.312	c1
Intralipid® 20%	0.272	0.269	0.268	0.345	0.344	0.344	c2
Vitalipid® N Adult	0.336	0.338	0.343	0.437	0.472	0.663	c3

1, 2, and 3 = number of determination

Table c4. Zeta potential of 10% and 20% commercial lipid emulsion and o/w emulsion containing oil-soluble vitamins

Commercial product	Zeta potential (mV)			
	1	2	3	4
Intralipid® 10%	-27.10	-23.75	-28.75	-17.29
Intralipid® 20%	-29.76	-30.57	-28.83	-38.21
Vitalipid® N Adult	-26.80	-28.08	-33.70	-23.40

1, 2, 3, and 4 = number of determination

Table c5. Osmolality of 10% and 20% commercial lipid emulsion and o/w emulsion containing oil-soluble vitamins

Commercial product	Osmolality (mOsm/kg)
Intralipid® 10%	287
Intralipid® 20%	333
Vitalipid® N Adult	292

APPENDIX D

PHYSICOCHEMICAL PROPERTIES OF FORMULATED LIPID EMULSIONS

1. Lipid emulsions containing 10% oil

Particle Size Measurement

Table d1. Particle size of lipid emulsion formulated using 10% blended oil (bo) with various cycles of homogenization

Formulation		Particle size of oil droplet (μm)						Figure
		D(0.5)			D[4,3]			
		1	2	3	1	2	3	
10% bo+ EPC	a)	0.399	0.415	0.416	0.720	0.637	0.637	d1
	b)	0.293	0.293	0.293	0.477	0.477	0.477	d2
	c)	0.263	0.263	0.263	0.283	0.283	0.283	d3
	d)	0.214	0.214	0.214	0.233	0.232	0.232	d4
	e)	0.383	0.384	0.386	0.748	0.795	0.782	d5
10% bo+ EPC+SA	a)	1.140	1.332	1.354	7.542	13.132	13.754	d6
	b)	0.311	0.311	0.312	0.463	0.466	0.473	d7
	c)	0.287	0.288	0.288	0.310	0.314	0.313	d8
	d)	0.242	0.242	0.242	0.263	0.263	0.263	d9
	e)	0.236	0.235	0.235	0.256	0.256	0.256	d10

1, 2, and 3 = number of determination

a) = unautoclaved emulsion passing homogenizer 3 cycles; b) = unautoclaved emulsion passing homogenizer 5 cycles; c) = unautoclaved emulsion passing homogenizer 7 cycles; d) = unautoclaved emulsion passing homogenizer 10 cycles; e) = autoclaved emulsion passing homogenizer 10 cycles

Table d2. Particle size of 10% blended oil (bo) unautoclaved or autoclaved emulsions using various types of phospholipids, and surfactants

Formulation		Particle size of oil droplets (μm)						Figure
		D(0.5)			D[4,3]			
		1	2	3	1	2	3	
10% bo+EPC	a.0)	0.214	0.214	0.214	0.233	0.232	0.232	d11
	a.6)	0.222	0.222	0.222	0.454	0.450	0.451	d12
	a.8)	0.224	0.223	0.223	0.403	0.392	0.392	d13
	a.16)	0.222	0.222	0.222	0.425	0.426	0.425	d14
	b.0)	0.383	0.384	0.386	0.748	0.795	0.782	d15
	b.6)	0.391	0.397	0.384	0.886	1.022	0.785	d16
	b.8)	0.398	0.387	0.382	0.751	0.719	0.665	d17
	b.16)	0.378	0.380	0.382	0.779	0.796	0.806	d18
10% bo+EPC +SA	a.0)	0.242	0.242	0.242	0.263	0.263	0.263	d19
	a.6)	0.238	0.238	0.238	0.259	0.259	0.259	d20
	a.8)	0.226	0.225	0.225	0.247	0.247	0.247	d21
	a.16)	0.226	0.233	0.233	0.248	0.255	0.255	d22
	b.0)	0.236	0.235	0.235	0.256	0.256	0.256	d23
	b.6)	0.236	0.236	0.236	0.257	0.257	0.257	d24
	b.8)	0.226	0.225	0.225	0.247	0.247	0.247	d25
	b.16)	0.235	0.235	0.235	0.257	0.258	0.258	d26
10% bo+EPC+T80	a.0)	0.184	0.184	-	0.192	0.192	-	d27
	a.1)	0.183	0.183	0.183	0.191	0.191	0.191	d28
	a.4)	0.183	0.183	0.184	0.191	0.191	0.192	d29
	a.12)	0.185	0.184	0.184	0.193	0.192	0.192	d30
	b.0)	1.293	1.300	-	1.579	1.585	-	d31
	b.1)	1.209	1.074	1.066	1.359	1.201	1.193	d32
	b.4)	1.443	1.451	1.444	1.738	1.745	1.737	d33
	b.12)	1.455	1.455	1.454	1.766	1.766	1.763	d34

1, 2, and 3 = number of determination

a.0) = unautoclaved; a.1) = unautoclaved after storage for 1 week; a.4) = unautoclaved after storage for 4 weeks; a.6) = unautoclaved after storage for 6 weeks; a.8) = unautoclaved after storage for 8 weeks; a.10) = unautoclaved after storage for 10 weeks; a.11) = unautoclaved after storage for 11 weeks; a.12) = unautoclaved after storage for 12 weeks; a.16) = unautoclaved after storage for 16 weeks

b.0) = autoclaved; b.1) = autoclaved after storage for 1 week; b.4) = autoclaved after storage for 4 weeks; b.6) = autoclaved after storage for 6 weeks; b.8) = autoclaved after storage for 8 weeks; b.10) = autoclaved after storage for 10 weeks; b.11) = autoclaved after storage for 11 weeks; b.12) = autoclaved after storage for 12 weeks; b. 14) = autoclaved after storage for 14 weeks; b.16) = autoclaved after storage for 16 weeks

Table d2 (cont.): Particle size of 10% blended oil (bo) unautoclaved or autoclaved emulsions using various types of phospholipids, and surfactants

Formulation		Particle size of oil droplets (μm)						Figure
		D(0.5)			D[4,3]			
		1	2	3	1	2	3	
10% bo+EPC+PG	a.0)	0.311	0.312	0.316	0.764	0.753	0.501	d35
	a.1)	0.334	0.356	0.390	0.820	1.000	1.159	d36
	a.4)	0.306	0.306	0.306	0.719	0.697	0.731	d37
	a.11)	0.330	0.330	0.330	0.507	0.507	0.508	d38
	b.0)	0.322	0.322	0.322	0.859	0.857	0.854	d39
	b.1)	0.317	0.320	0.323	0.683	0.704	0.708	d40
	b.4)	0.309	0.309	0.309	0.665	0.680	0.669	d41
	b.11)	0.350	0.363	0.391	1.042	1.215	1.356	d42
10% bo+EPC+T80+SA	a.0)	0.188	0.188	0.188	0.197	0.197	0.197	d43
	a.1)	0.187	0.187	0.187	0.196	0.196	0.196	d44
	a.4)	0.186	0.186	0.186	0.195	0.194	0.194	d45
	a.10)	1.924	1.919	1.920	2.043	2.039	2.039	d46
	b.0)	0.188	0.188	0.188	0.198	0.198	0.198	d47
	b.1)	0.187	0.187	0.187	0.196	0.196	0.196	d48
	b.4)	0.187	0.187	0.187	0.197	0.196	0.196	d49
	b.10)	0.188	0.188	0.188	0.198	0.198	0.198	d50
10% bo+SPC+T80+SA	a.0)	0.186	0.186	0.186	0.195	0.195	0.195	d51
	a.1)	0.185	0.185	0.185	0.194	0.194	0.194	d52
	a.4)	0.184	0.184	0.184	0.193	0.192	0.192	d53
	a.10)	0.199	0.198	0.198	1.847	1.720	1.666	d54
	b.0)	0.186	0.186	0.186	0.195	0.195	0.195	d55
	b.1)	0.186	0.186	0.186	0.194	0.194	0.194	d56
	b.4)	0.186	0.186	0.186	0.194	0.194	0.194	d57
	b.10)	0.185	0.185	0.185	0.194	0.194	0.194	d58

1, 2, and 3 = number of determination

a.0) = unautoclaved; a.1) = unautoclaved after storage for 1 week; a.4) = unautoclaved after storage for 4 weeks; a.6) = unautoclaved after storage for 6 weeks; a.8) = unautoclaved after storage for 8 weeks; a.10) = unautoclaved after storage for 10 weeks; a.11) = unautoclaved after storage for 11 weeks; a.12) = unautoclaved after storage for 12 weeks; a.16) = unautoclaved after storage for 16 weeks

b.0) = autoclaved; b.1) = autoclaved after storage for 1 week; b.4) = autoclaved after storage for 4 weeks; b.6) = autoclaved after storage for 6 weeks; b.8) = autoclaved after storage for 8 weeks; b.10) = autoclaved after storage for 10 weeks; b.11) = autoclaved after storage for 11 weeks; b.12) = autoclaved after storage for 12 weeks; b. 14) = autoclaved after storage for 14 weeks; b.16) = autoclaved after storage for 16 weeks

Table d3. Particle size of 10% soybean oil (so) unautoclaved or autoclaved emulsions using various types of phospholipids, and surfactants

Formulation		Particle size of oil droplets (μm)						Figure
		D(0.5)			D[4,3]			
		1	2	3	1	2	3	
10% so+EPC	a.0)	0.287	0.287	-	0.382	0.383	-	d59
	a.3)	0.282	0.282	0.282	0.377	0.380	0.383	d60
	a.4)	0.345	0.308	0.307	0.490	0.412	0.410	d61
	a.14)	0.322	0.325	0.316	0.436	0.452	0.430	d62
	b.0)	0.303	0.311	-	0.527	0.627	-	d63
	b.3)	0.315	0.305	0.303	0.445	0.411	0.402	d64
	b.4)	0.314	0.314	0.314	0.410	0.409	0.408	d65
	b.14)	0.331	0.314	0.314	0.459	0.406	0.405	d66
10% so+EPC+SA	a.0)	0.301	0.314	-	0.796	2.511	-	d67
	a.3)	0.289	0.289	0.290	1.151	1.241	1.247	d68
	a.4)	0.300	0.299	0.299	0.395	0.396	0.396	d69
	a.14)	0.297	0.296	0.296	0.388	0.387	0.386	d70
	b.0)	0.284	0.294	-	0.478	0.515	-	d71
	b.3)	0.293	0.294	0.294	0.386	0.389	0.386	d72
	b.4)	0.296	0.296	0.296	0.388	0.388	0.388	d73
	b.14)	0.315	0.315	0.315	0.463	0.462	0.461	d74
10% so+EPC+T80	a.0)	0.190	0.190	-	0.200	0.200	-	d75
	a.1)	0.188	0.188	0.188	0.197	0.197	0.197	d76
	a.4)	0.186	0.187	0.187	0.195	0.195	0.195	d77
	a.12)	0.189	0.189	0.189	0.198	0.198	0.198	d78
	b.0)	0197	0.197	-	0.209	0.209	-	d79
	b.1)	0.196	0.196	0.196	0.208	0.207	0.207	d80
	b.4)	0.200	0.199	0.199	0.213	0.212	0.212	d81
	b.12)	0.193	0.193	0.193	0.203	0.203	0.203	d82

1, 2, and 3 = number of determination

a.0) = unautoclaved; a.1) = unautoclaved after storage for 1 week; a.3) = unautoclaved after storage for 3 weeks; a.4) = unautoclaved after storage for 4 weeks; a.10) = unautoclaved after storage for 10 weeks; a.11) = unautoclaved after storage for 11 weeks; a.12) = unautoclaved after storage for 12 weeks; a.14) = unautoclaved after storage for 14 weeks

b.0) = autoclaved; b.1) = autoclaved after storage for 1 week; b.3) = autoclaved after storage for 3 weeks; b.4) = autoclaved after storage for 4 weeks; b.10) = autoclaved after storage for 10 weeks; b.11) = autoclaved after storage for 11 weeks; b.12) = autoclaved after storage for 12 weeks; b. 14) = autoclaved after storage for 14 weeks; b.16) = autoclaved after storage for 16 weeks

Table d3 (cont.). Particle size of 10% soybean oil (so) unautoclaved or autoclaved emulsions using various types of phospholipids, and surfactants

Formulation		Particle size of oil droplets (μm)						Figure
		D(0.5)			D[4,3]			
		1	2	3	1	2	3	
10% so+EPC+PG	a.0)	0.345	0.343	0.344	0.791	0.811	0.771	d83
	a.1)	0.398	0.434	0.486	0.928	1.126	1.266	d84
	a.4)	0.358	0.357	0.359	0.679	0.696	0.675	d85
	a.11)	0.371	0.371	0.371	0.716	0.754	0.757	d86
	b.0)	0.367	0.367	0.368	0.774	0.795	0.792	d87
	b.1)	0.356	0.359	0.364	0.736	0.788	0.833	d88
	b.4)	0.350	0.352	0.351	0.686	0.660	0.676	d89
	b.11)	0.364	0.393	0.416	0.778	1.053	1.216	d90
10% so+EPC+T80+SA	a.0)	0.191	0.191	0.191	0.202	0.202	0.202	d91
	a.1)	0.190	0.190	0.190	0.200	0.200	0.200	d92
	a.4)	0.188	0.188	0.188	0.198	0.98	0.198	d93
	a.10)	0.191	0.190	0.191	0.201	0.201	0.201	d94
	b.0)	0.192	0.191	0.190	0.202	0.201	0.201	d95
	b.1)	0.190	0.190	0.190	0.200	0.200	0.200	d96
	b.4)	0.192	0.191	0.191	0.202	0.202	0.201	d97
	b.10)	0.191	0.191	0.191	0.201	0.201	0.201	d98
10% so+SPC+T80+SA	a.0)	0.188	0.188	0.188	0.198	0.198	0.198	d99
	a.1)	0.188	0.188	0.188	0.197	0.197	0.197	d100
	a.4)	0.186	0.186	0.186	0.194	0.194	0.194	d101
	a.10)	0.438	0.444	0.445	0.651	0.651	0.652	d102
	b.0)	0.188	0.188	0.188	0.198	0.197	0.197	d103
	b.1)	0.188	0.188	0.188	0.197	0.197	0.197	d104
	b.4)	1.848	1.844	1.846	2.917	2.878	2.925	d105
	b.10)	0.188	0.188	0.188	0.197	0.197	0.197	d106

1, 2, and 3 = number of determination

a.0) = unautoclaved; a.1) = unautoclaved after storage for 1 week; a.3) = unautoclaved after storage for 3 weeks; a.4) = unautoclaved after storage for 4 weeks; a.10) = unautoclaved after storage for 10 weeks; a.11) = unautoclaved after storage for 11 weeks; a.12) = unautoclaved after storage for 12 weeks; a.14) = unautoclaved after storage for 14 weeks

b.0) = autoclaved; b.1) = autoclaved after storage for 1 week; b.3) = autoclaved after storage for 3 weeks; b.4) = autoclaved after storage for 4 weeks; b.10) = autoclaved after storage for 10 weeks; b.11) = autoclaved after storage for 11 weeks; b.12) = autoclaved after storage for 12 weeks; b. 14) = autoclaved after storage for 14 weeks; b.16) = autoclaved after storage for 16 weeks

Zeta Potential Measurement

Table d4. Zeta potential of 10% blended oil (bo) unautoclaved or autoclaved emulsions using various types of phospholipids, and surfactants

Formulation		Zeta potential (mV)			
		1	2	3	4
10% bo+EPC	a.0)	-11.29	-8.01	-5.90	-6.91
	a.6)	-18.23	-15.15	-16.95	-16.56
	a.8)	-15.10	-20.07	-18.48	-18.71
	a.16)	-17.73	-10.53	-12.93	-10.05
	b.0)	-24.85	-26.51	-26.13	-26.05
	b.6)	-23.46	-23.50	-23.51	-20.51
	b.8)	-22.41	-22.26	-19.46	-23.41
	b.16)	-23.27	-27.83	-28.61	-28.09
10% bo+EPC +SA	a.0)	53.39	51.02	48.47	47.17
	a.6)	22.84	29.99	20.54	24.47
	a.8)	27.17	18.28	18.21	21.76
	a.16)	26.31	28.09	26.16	21.87
	b.0)	37.64	39.84	39.76	40.72
	b.6)	19.09	20.49	20.48	23.47
	b.8)	28.96	27.05	22.00	26.62
	b.16)	18.78	15.85	19.81	20.82
10% bo+EPC+T80	a.0)	-10.50	-15.29	-12.32	-15.57
	a.1)	-16.25	-8.47	-5.74	-10.15
	a.4)	-11.58	-7.73	-15.18	-15.21
	a.12)	-13.54	-10.51	-14.18	-14.93
	b.0)	-7.41	-13.45	-8.50	-13.72
	b.1)	-7.09	-8.03	-14.14	-9.61
	b.4)	-14.84	-14.32	-14.87	-14.33
	b.12)	-25.03	-24.28	-18.98	-16.58

1, 2, 3 and 4 = number of determination

a.0) = unautoclaved; a.1) = unautoclaved after storage for 1 week; a.4) = unautoclaved after storage for 4 weeks; a.6) = unautoclaved after storage for 6 weeks; a.8) = unautoclaved after storage for 8 weeks; a.10) = unautoclaved after storage for 10 weeks; a.11) = unautoclaved after storage for 11 weeks; a.12) = unautoclaved after storage for 12 weeks; a.16) = unautoclaved after storage for 16 weeks

b.0) = autoclaved; b.1) = autoclaved after storage for 1 week; b.4) = autoclaved after storage for 4 weeks; b.6) = autoclaved after storage for 6 weeks; b.8) = autoclaved after storage for 8 weeks; b.10) = autoclaved after storage for 10 weeks; b.11) = autoclaved after storage for 11 weeks; b.12) = autoclaved after storage for 12 weeks; b. 14) = autoclaved after storage for 14 weeks; b.16) = autoclaved after storage for 16 weeks

Table d4 (cont). Zeta potential of 10% blended oil (bo) unautoclaved or autoclaved emulsions using various types of phospholipids, and surfactants

Formulation		Zeta potential (mV)			
		1	2	3	4
10% bo+EPC+PG	a.0)	-17.70	-20.96	-16.60	-20.13
	a.1)	-9.94	-11.48	-15.56	-17.39
	a.4)	-20.84	-23.12	-20.73	-21.62
	a.11)	-29.29	-24.36	-27.44	-25.96
	b.0)	-18.97	-23.00	-21.31	-18.75
	b.1)	-17.88	-19.91	-21.08	-21.93
	b.4)	-21.07	-20.92	-23.19	-20.11
	b.11)	-31.03	-26.80	-33.69	-28.79
10% bo+EPC+T80+SA	a.0)	25.11	25.47	25.89	24.13
	a.1)	17.23	21.87	17.45	16.08
	a.4)	26.58	27.03	25.60	18.63
	a.10)	16.86	16.65	14.00	17.75
	b.0)	16.88	23.76	15.84	34.90
	b.1)	12.53	13.46	17.98	18.58
	b.4)	17.08	16.19	15.41	16.89
	b.10)	18.16	19.09	18.75	18.82
10% bo+SPC+T80+SA	a.0)	24.90	20.70	20.83	25.41
	a.1)	20.19	20.19	23.46	17.84
	a.4)	12.05	12.95	23.85	21.26
	a.10)	17.03	20.95	18.21	22.98
	b.0)	19.48	16.14	23.54	23.84
	b.1)	15.07	16.93	22.29	23.08
	b.4)	10.38	9.20	9.84	4.52
	b.10)	7.22	11.74	13.90	5.55

1, 2, 3 and 4 = number of determination

a.0) = unautoclaved; a.1) = unautoclaved after storage for 1 week; a.4) = unautoclaved after storage for 4 weeks; a.6) = unautoclaved after storage for 6 weeks; a.8) = unautoclaved after storage for 8 weeks; a.10) = unautoclaved after storage for 10 weeks; a.11) = unautoclaved after storage for 11 weeks; a.12) = unautoclaved after storage for 12 weeks; a.16) = unautoclaved after storage for 16 weeks

b.0) = autoclaved; b.1) = autoclaved after storage for 1 week; b.4) = autoclaved after storage for 4 weeks; b.6) = autoclaved after storage for 6 weeks; b.8) = autoclaved after storage for 8 weeks; b.10) = autoclaved after storage for 10 weeks; b.11) = autoclaved after storage for 11 weeks; b.12) = autoclaved after storage for 12 weeks; b. 14) = autoclaved after storage for 14 weeks; b.16) = autoclaved after storage for 16 weeks

Table d5. Zeta potential of 10% soybean oil (so) unautoclaved or autoclaved emulsions using various types of phospholipids, and surfactants

Formulation		Zeta potential (mV)			
		1	2	3	4
10% so+EPC	a.0)	-29.95	-26.42	-25.50	-23.57
	a.3)	-18.83	-17.71	-21.86	-16.57
	a.4)	-7.76	-8.81	-11.65	-7.34
	a.14)	-11.42	-11.51	-7.74	-11.58
	b.0)	-13.62	-17.59	-10.76	-20.05
	b.3)	-9.03	-12.26	-14.94	-9.54
	b.4)	-17.58	-17.34	-21.88	-22.63
	b.14)	-22.57	-20.52	-16.79	-22.47
10% so+EPC+SA	a.0)	29.66	32.18	31.23	33.62
	a.3)	31.62	21.48	19.21	24.08
	a.4)	30.00	32.00	29.97	32.75
	a.14)	11.45	11.11	10.63	10.02
	b.0)	1.82	4.71	3.81	14.39
	b.3)	12.07	14.13	13.68	14.26
	b.4)	12.28	9.71	9.94	16.93
	b.14)	11.60	7.41	10.07	9.27
10% so+EPC+T80	a.0)	-13.88	-14.46	-15.26	-15.55
	a.1)	-7.22	-7.40	-8.87	-6.43
	a.4)	-18.44	-7.78	-13.98	-9.31
	a.12)	-8.52	-5.72	-5.69	-6.66
	b.0)	-15.99	-13.65	-12.46	-14.52
	b.1)	-8.56	-7.95	-8.94	-6.45
	b.4)	-9.98	-13.16	-12.25	-13.86
	b.12)	-9.43	-8.82	-10.38	-9.64

1, 2, 3 and 4 = number of determination

a.0) = unautoclaved; a.1) = unautoclaved after storage for 1 week; a.3) = unautoclaved after storage for 3 weeks; a.4) = unautoclaved after storage for 4 weeks; a.10) = unautoclaved after storage for 10 weeks; a.11) = unautoclaved after storage for 11 weeks; a.12) = unautoclaved after storage for 12 weeks; a.14) = unautoclaved after storage for 14 weeks

b.0) = autoclaved; b.1) = autoclaved after storage for 1 week; b.3) = autoclaved after storage for 3 weeks; b.4) = autoclaved after storage for 4 weeks; b.10) = autoclaved after storage for 10 weeks; b.11) = autoclaved after storage for 11 weeks; b.12) = autoclaved after storage for 12 weeks; b. 14) = autoclaved after storage for 14 weeks; b.16) = autoclaved after storage for 16 weeks

Table d5 (cont.). Zeta potential of 10% soybean oil (so) unautoclaved or autoclaved emulsions using various types of phospholipids, and surfactants

Formulation		Zeta potential (mV)			
		1	2	3	4
10% so+EPC+PG	a.0)	-17.01	-21.22	-15.62	-17.37
	a.1)	-23.15	-24.42	-15.55	-18.51
	a.4)	-24.82	-26.50	-24.11	-24.24
	a.11)	-31.13	-25.16	-18.38	-19.91
	b.0)	-29.02	-30.19	-28.91	-33.43
	b.1)	-27.24	-28.68	-26.93	-30.95
	b.4)	-30.72	-26.93	-30.83	-33.29
	b.11)	-16.82	-22.46	-24.66	-20.68
10% so+EPC+T80+SA	a.0)	21.94	23.20	27.16	20.39
	a.1)	19.15	12.20	14.51	16.04
	a.4)	16.08	17.85	16.27	17.96
	a.10)	23.59	14.77	19.22	15.64
	b.0)	8.73	8.84	11.31	12.80
	b.1)	13.67	12.70	13.55	24.49
	b.4)	21.43	16.23	19.09	25.07
	b.10)	7.33	13.71	14.72	14.89
10% so+SPC+T80+SA	a.0)	19.36	19.83	22.15	19.91
	a.1)	17.58	20.70	19.95	20.54
	a.4)	26.24	24.98	29.18	18.39
	a.10)	22.65	19.36	17.93	22.79
	b.0)	12.25	12.47	11.08	9.69
	b.1)	11.15	19.94	16.05	16.17
	b.4)	14.65	14.34	15.44	16.49
	b.10)	9.32	18.24	12.93	17.49

1, 2, 3 and 4 = number of determination

a.0) = unautoclaved; a.1) = unautoclaved after storage for 1 week; a.3) = unautoclaved after storage for 3 weeks; a.4) = unautoclaved after storage for 4 weeks; a.10) = unautoclaved after storage for 10 weeks; a.11) = unautoclaved after storage for 11 weeks; a.12) = unautoclaved after storage for 12 weeks; a.14) = unautoclaved after storage for 14 weeks

b.0) = autoclaved; b.1) = autoclaved after storage for 1 week; b.3) = autoclaved after storage for 3 weeks; b.4) = autoclaved after storage for 4 weeks; b.10) = autoclaved after storage for 10 weeks; b.11) = autoclaved after storage for 11 weeks; b.12) = autoclaved after storage for 12 weeks; b. 14) = autoclaved after storage for 14 weeks; b.16) = autoclaved after storage for 16 weeks

pH Measurement

Table d6. pH of 10% blended oil (bo) unautoclaved or autoclaved emulsions using various types of phospholipids, and surfactants

Formulation		pH of lipid emulsion
10% bo+EPC	a.0)	8.06
	a.6)	7.31
	a.8)	7.28
	a.16)	7.29
	b.0)	6.21
	b.6)	6.32
	b.8)	6.22
	b.16)	6.65
10% bo+EPC +SA	a.0)	8.01
	a.6)	6.34
	a.8)	6.47
	a.16)	6.18
	b.0)	6.25
	b.6)	6.02
	b.8)	6.04
	b.16)	5.92
10% bo+EPC+T80	a.0)	8.04
	a.1)	7.56
	a.4)	7.61
	a.12)	7.48
	b.0)	6.66
	b.1)	6.84
	b.4)	7.12
	b.12)	6.97

a.0) = unautoclaved; a.1) = unautoclaved after storage for 1 week; a.4) = unautoclaved after storage for 4 weeks; a.6) = unautoclaved after storage for 6 weeks; a.8) = unautoclaved after storage for 8 weeks; a.10) = unautoclaved after storage for 10 weeks; a.11) = unautoclaved after storage for 11 weeks; a.12) = unautoclaved after storage for 12 weeks; a.16) = unautoclaved after storage for 16 weeks

b.0) = autoclaved; b.1) = autoclaved after storage for 1 week; b.4) = autoclaved after storage for 4 weeks; b.6) = autoclaved after storage for 6 weeks; b.8) = autoclaved after storage for 8 weeks; b.10) = autoclaved after storage for 10 weeks; b.11) = autoclaved after storage for 11 weeks; b.12) = autoclaved after storage for 12 weeks; b. 14) = autoclaved after storage for 14 weeks; b.16) = autoclaved after storage for 16 weeks

Table d6 (cont.). pH of 10% blended oil (bo) unautoclaved or autoclaved emulsions using various types of phospholipids, and surfactants

Formulation		pH of lipid emulsion
10% bo+EPC+PG	a.0)	8.02
	a.1)	7.29
	a.4)	7.52
	a.11)	8.11
	b.0)	7.44
	b.1)	7.51
	b.4)	7.84
	b.11)	8.16
10% bo+EPC+T80+SA	a.0)	8.04
	a.1)	7.32
	a.4)	6.77
	a.10)	6.55
	b.0)	6.22
	b.1)	5.87
	b.4)	5.91
	b.10)	5.90
10% bo+SPC+T80+SA	a.0)	8.04
	a.1)	7.43
	a.4)	7.05
	a.10)	6.64
	b.0)	6.34
	b.1)	6.62
	b.4)	6.03
	b.10)	6.20

a.0) = unautoclaved; a.1) = unautoclaved after storage for 1 week; a.4) = unautoclaved after storage for 4 weeks; a.6) = unautoclaved after storage for 6 weeks; a.8) = unautoclaved after storage for 8 weeks; a.10) = unautoclaved after storage for 10 weeks; a.11) = unautoclaved after storage for 11 weeks; a.12) = unautoclaved after storage for 12 weeks; a.16) = unautoclaved after storage for 16 weeks

b.0) = autoclaved; b.1) = autoclaved after storage for 1 week; b.4) = autoclaved after storage for 4 weeks; b.6) = autoclaved after storage for 6 weeks; b.8) = autoclaved after storage for 8 weeks; b.10) = autoclaved after storage for 10 weeks; b.11) = autoclaved after storage for 11 weeks; b.12) = autoclaved after storage for 12 weeks; b. 14) = autoclaved after storage for 14 weeks; b.16) = autoclaved after storage for 16 weeks

Table d7. pH of 10% soybean oil (so) unautoclaved or autoclaved emulsions using various types of phospholipids, and surfactants

Formulation		pH of lipid emulsion
10% so+EPC	a.0)	8.01
	a.3)	7.01
	a.4)	6.80
	a.14)	6.73
	b.0)	6.68
	b.3)	6.71
	b.4)	6.77
	b.14)	7.16
10% so+EPC+SA	a.0)	8.01
	a.3)	6.94
	a.4)	6.68
	a.14)	5.56
	b.0)	5.54
	b.3)	5.65
	b.4)	5.75
	b.14)	5.97
10% so+EPC+T80	a.0)	8.01
	a.1)	7.55
	a.4)	7.51
	a.12)	7.39
	b.0)	6.68
	b.1)	6.79
	b.4)	6.95
	b.12)	6.56

a.0) = unautoclaved; a.1) = unautoclaved after storage for 1 week; a.3) = unautoclaved after storage for 3 weeks; a.4) = unautoclaved after storage for 4 weeks; a.10) = unautoclaved after storage for 10 weeks; a.11) = unautoclaved after storage for 11 weeks; a.12) = unautoclaved after storage for 12 weeks; a.14) = unautoclaved after storage for 14 weeks

b.0) = autoclaved; b.1) = autoclaved after storage for 1 week; b.3) = autoclaved after storage for 3 weeks; b.4) = autoclaved after storage for 4 weeks; b.10) = autoclaved after storage for 10 weeks; b.11) = autoclaved after storage for 11 weeks; b.12) = autoclaved after storage for 12 weeks; b. 14) = autoclaved after storage for 14 weeks; b.16) = autoclaved after storage for 16 weeks

Table d7 (cont.). pH of 10% soybean oil (so) unautoclaved or autoclaved emulsions using various types of phospholipids, and surfactants

Formulation		pH of lipid emulsion
10% so+EPC+PG	a.0)	8.05
	a.1)	6.99
	a.4)	7.50
	a.11)	7.87
	b.0)	7.26
	b.1)	7.23
	b.4)	7.17
	b.11)	7.05
10% so+EPC+T80+SA	a.0)	8.03
	a.1)	7.67
	a.4)	7.17
	a.10)	6.66
	b.0)	6.47
	b.1)	6.69
	b.4)	6.19
	b.10)	6.08
10% so+SPC+T80+SA	a.0)	8.07
	a.1)	7.63
	a.4)	7.06
	a.10)	6.79
	b.0)	6.62
	b.1)	6.81
	b.4)	6.40
	b.10)	6.33

a.0) = unautoclaved; a.1) = unautoclaved after storage for 1 week; a.3) = unautoclaved after storage for 3 weeks; a.4) = unautoclaved after storage for 4 weeks; a.10) = unautoclaved after storage for 10 weeks; a.11) = unautoclaved after storage for 11 weeks; a.12) = unautoclaved after storage for 12 weeks; a.14) = unautoclaved after storage for 14 weeks

b.0) = autoclaved; b.1) = autoclaved after storage for 1 week; b.3) = autoclaved after storage for 3 weeks; b.4) = autoclaved after storage for 4 weeks; b.10) = autoclaved after storage for 10 weeks; b.11) = autoclaved after storage for 11 weeks; b.12) = autoclaved after storage for 12 weeks; b. 14) = autoclaved after storage for 14 weeks; b.16) = autoclaved after storage for 16 weeks

2. Lipid emulsions containing 20% oil

Particle Size Measurement

Table d8. Particle size of 20% blended oil (bo) unautoclaved or autoclaved emulsions using various types of surfactants

Formulation		Particle size of oil droplets (μm)						Figure
		D(0.5)			D[4,3]			
		1	2	3	1	2	3	
20% bo+EPC	a.0)	0.545	0.532	-	0.687	0.734	-	d107
	a.3)	0.513	0.549	0.569	0.598	0.794	0.925	d108
	a.4)	0.442	0.430	0.430	0.558	0.522	0.522	d109
	a.14)	0.895	0.889	0.875	0.908	0.911	0.896	d110
	b.0)	0.783	0.825	-	0.976	1.085	-	d111
	b.3)	0.812	0.749	0.753	0.822	0.772	0.762	d112
	b.4)	0.758	0.755	0.755	0.766	0.763	0.762	d113
	b.14)	1.041	0.981	0.958	1.392	1.031	0.995	d114
20% bo+EPC+SA	a.0)	0.444	0.444	-	0.657	0.657	-	d115
	a.3)	0.472	0.472	0.504	0.567	0.565	0.596	d116
	a.4)	0.411	0.412	0.413	0.510	0.509	0.509	d117
	a.14)	0.513	0.521	0.522	0.644	0.467	0.647	d118
	b.0)	0.489	0.496	-	0.590	0.734	-	d119
	b.3)	0.463	0.463	0.463	0.565	0.563	0.592	d120
	b.4)	0.478	0.484	0.484	0.579	0.581	0.581	d121
	b.14)	0.479	0.485	0.486	0.578	0.579	0.579	d122

1, 2 and 3 = number of determination

a.0) = unautoclaved; a.3) = unautoclaved after storage for 3 weeks; a.4) = unautoclaved after storage for 4 weeks; a.14) = unautoclaved after storage for 14 weeks

b.0) = autoclaved; b.3) = autoclaved after storage for 3 weeks; b.4) = autoclaved after storage for 4 weeks; b.14) = autoclaved after storage for 14 weeks

Zeta Potential Measurement

Table d9. Zeta potential of 20% blended oil (bo) unautoclaved or autoclaved emulsions using various types of surfactants

Formulation		Zeta potential (mV)			
		1	2	3	4
20% bo+EPC	a.0)	-12.30	-17.51	-20.37	-11.99
	a.3)	-10.79	-18.57	-11.18	-10.49
	a.4)	-12.83	-16.28	-12.53	-14.32
	a.14)	-12.14	-17.91	-4.22	-6.37
	b.0)	-21.64	-19.42	-18.81	-17.82
	b.3)	-28.37	-14.86	-15.15	-23.88
	b.4)	-15.42	-16.64	-16.53	-17.63
	b.14)	-12.83	-14.32	-16.28	-12.53
20% bo+EPC+SA	a.0)	34.52	36.22	36.65	31.72
	a.3)	28.59	28.83	31.00	31.26
	a.4)	33.52	31.09	30.59	33.59
	a.14)	22.79	28.75	13.65	24.37
	b.0)	11.59	8.58	12.06	13.96
	b.3)	12.40	15.29	7.30	7.53
	b.4)	19.19	19.63	18.31	16.20
	b.14)	4.94	13.63	5.05	6.53

1, 2, 3 and 4 = number of determination

a.0) = unautoclaved; a.3) = unautoclaved after storage for 3 weeks; a.4) = unautoclaved after storage for 4 weeks; a.14) = unautoclaved after storage for 16 weeks

b.0) = autoclaved; b.3) = autoclaved after storage for 3 weeks; b.4) = autoclaved after storage for 4 weeks; b.14) = autoclaved after storage for 14 weeks

pH Measurement

Table d10. pH of 20% blended oil (bo) unautoclaved or autoclaved emulsions using various types of surfactants

Formulation		pH of lipid emulsion
20% bo+EPC	a.0)	8.06
	a.3)	7.15
	a.4)	7.21
	a.14)	6.79
	b.0)	6.61
	b.3)	6.86
	b.4)	6.84
	b.14)	6.99
20% bo+EPC+SA	a.0)	8.01
	a.3)	6.90
	a.4)	6.54
	a.14)	5.80
	b.0)	5.75
	b.3)	5.76
	b.4)	5.85
	b.14)	6.01

a.0) = unautoclaved; a.3) = unautoclaved after storage for 3 weeks; a.4) = unautoclaved after storage for 4 weeks; a.14) = unautoclaved after storage for 16 weeks

b.0) = autoclaved; b.3) = autoclaved after storage for 3 weeks; b.4) = autoclaved after storage for 4 weeks; b.14) = autoclaved after storage for 14 weeks

3. Lipid emulsion containing oil-soluble vitamins

Particle size measurement

Table d11. Particle size of 10% soybean oil (so) unautoclaved or autoclaved emulsions containing oil-soluble vitamins using various type of surfactants

Formulation	Sterilization		Particle size of oil droplets (μm)						Figure
			D(0.5)			D[4,3]			
			1	2	3	1	2	3	
10% so+EPC+T80	Non-sterilization	a)	0.189	0.189	0.189	0.199	0.199	0.199	d123
		b)	0.189	0.189	0.189	0.199	0.199	0.199	d124
		c)	0.188	0.188	0.188	0.198	0.197	0.197	d125
	Filtration	a)	0.189	0.189	0.189	0.198	0.199	0.199	d126
		b)	0.189	0.189	0.189	0.199	0.199	0.199	d127
		c)	0.187	0.187	0.187	0.196	0.196	0.196	d128
	Autoclaving	a)	0.190	0.190	0.190	0.199	0.199	0.199	d129
		b)	0.189	0.188	0.189	0.198	0.197	0.197	d130
		c)	0.190	0.190	0.190	0.199	0.199	0.199	d131
10% so+EPC+T80+PG	Non-sterilization	a)	0.191	0.191	0.191	0.202	0.201	0.202	d132
		b)	0.188	0.188	0.188	0.198	0.198	0.198	d133
		c)	0.190	0.189	0.189	0.200	0.198	0.198	d134
	Filtration	a)	0.189	0.189	0.189	0.198	0.198	0.198	d135
		b)	0.189	0.189	0.189	0.199	0.199	0.199	d136
		c)	0.189	0.189	0.189	0.198	0.198	0.198	d137
	Autoclaving	a)	0.188	0.188	0.187	0.197	0.197	0.196	d138
		b)	0.190	0.189	0.189	0.199	0.199	0.199	d139
		c)	0.190	0.190	0.190	0.201	0.200	0.200	d140
10% so+EPC+T80+SA	Non-sterilization	a)	0.192	0.192	0.192	0.203	0.202	0.202	d141
		b)	0.190	0.190	0.190	0.200	0.200	0.200	d142
		c)	0.190	0.190	0.190	0.201	0.200	0.200	d143
	Filtration	a)	0.190	0.189	0.190	0.199	0.199	0.199	d144
		b)	0.188	0.188	0.188	0.198	0.197	0.198	d145
		c)	0.189	0.188	0.188	0.198	0.198	0.198	d146
	Autoclaving	a)	0.192	0.191	0.191	0.203	0.202	0.202	d147
		b)	0.192	0.191	0.191	0.202	0.201	0.201	d148
		c)	0.191	0.190	0.190	0.201	0.200	0.200	d149

1, 2 and 3 = number of determination

a) = immediately after preparation; b) 1 week after preparation; c) = 1 month after preparation

Zeta Potential Measurement

Table d12. Zeta potential of 10% soybean oil (so) unautoclaved or autoclaved emulsions containing oil-soluble vitamins using various type of surfactants

Formulation	Sterilization		Zeta potential (mV)			
			1	2	3	4
10% so+EPC+T80	Non-sterilization	a)	-5.77	-14.41	-10.65	-14.59
		b)	-6.48	-2.89	-7.69	-9.66
		c)	-10.13	-16.27	-12.45	-13.43
	Filtration	a)	-15.10	-12.87	-11.47	-16.79
		b)	-7.40	-15.07	-16.21	-10.36
		c)	-13.54	-13.03	-11.29	-14.14
	Autoclaving	a)	-9.28	-10.69	-13.28	-14.54
		b)	-10.52	-8.59	-6.66	-6.67
		c)	-13.55	-19.73	-16.98	-10.41
10% so+EPC+T80+PG	Non-sterilization	a)	-12.74	-11.97	-20.17	-16.03
		b)	-18.17	-11.25	-15.90	-14.07
		c)	-15.60	-14.36	-16.17	-17.29
	Filtration	a)	-12.17	-10.33	-14.10	-14.13
		b)	-16.53	-13.62	-14.77	-12.04
		c)	-16.42	-16.97	-17.96	-18.99
	Autoclaving	a)	-16.92	-10.16	-18.61	-13.07
		b)	-14.18	-14.72	-18.47	-18.82
		c)	-19.44	-18.74	-21.64	-29.10
10% so+EPC+T80+SA	Non-sterilization	a)	31.27	28.88	33.63	33.50
		b)	22.99	26.15	22.79	25.02
		c)	13.98	14.88	15.34	17.07
	Filtration	a)	25.92	24.90	20.89	27.94
		b)	22.04	24.40	20.87	23.69
		c)	19.29	20.80	20.81	23.72
	Autoclaving	a)	19.26	19.16	20.70	23.80
		b)	21.06	18.17	18.22	23.92
		c)	15.95	12.70	10.93	17.25

1, 2, 3 and 4 = number of determination

a) = immediately after preparation; b) 1 week after preparation; c) = 1 month after preparation

pH Measurement

Table d13. pH of 10% soybean oil (so) unautoclaved or autoclaved emulsions containing oil-soluble vitamins using various type of surfactants

Formulation	Sterilization		pH of lipid emulsion
10% so+EPC+T80	Non-sterilization	a)	7.99
		b)	7.43
		c)	7.95
	Filtration	a)	7.02
		b)	6.72
		c)	6.59
	Autoclaving	a)	7.19
		b)	7.18
		c)	7.48
10% so+EPC+T80+PG	Non-sterilization	a)	8.01
		b)	7.60
		c)	7.46
	Filtration	a)	6.81
		b)	6.61
		c)	6.55
	Autoclaving	a)	6.99
		b)	7.19
		c)	7.14
10% so+EPC+T80+SA	Non-sterilization	a)	8.01
		b)	7.55
		c)	6.84
	Filtration	a)	7.96
		b)	8.03
		c)	6.78
	Autoclaving	a)	7.09
		b)	7.26
		c)	6.77

a) = immediately after preparation; b) 1 week after preparation; c) = 1 month after preparation

APPENDIX E

VITAMIN CONTENT ANALYSIS

Table e1. Peak area ratio of standard oil-soluble vitamins achieved using HPLC technique

Vitamin	Concentration (μg/ml)	Peak area ratio		
		1	2	3
Vitamin A Palmitate	10	3.29	3.36	3.35
	20	7.13	7.20	6.93
	30	10.74	10.60	10.64
	40	14.10	14.86	14.62
	50	17.94	17.96	18.26
Vitamin D3	0.50	0.47	0.50	0.49
	1.00	0.83	0.84	0.83
	1.50	1.07	1.11	1.11
	2.00	1.42	1.39	1.39
	2.50	1.83	1.80	1.79
	3.00	2.02	2.04	2.03
Vitamin E acetate	60	4.74	4.73	4.71
	80	5.89	5.92	5.86
	100	7.58	7.58	7.62
	120	9.05	9.02	8.93
	140	10.18	10.26	10.24
Vitamin K1	1.00	0.26	0.27	0.26
	1.50	0.40	0.41	0.41
	2.00	0.51	0.52	0.53
	2.50	0.68	0.69	0.67
	3.00	0.77	0.81	0.78

1, 2, and 3 = number of determination

Table e2. Peak area ratio, amount of vitamins and % remaining of oil-soluble vitamins found in commercial product

Commercial product	Vitamins		Peak area ratio	Amount of vitamins	% Remaining	Figure
Vitalipid®	Vitamin A	1)	10.64	29.75	90.15	e1
		2)	9.78	27.42	83.09	
		3)	10.44	29.21	88.51	
	Vitamin D_2	1)	0.23	0.08	3.78	
		2)	0.19	0.01	0.58	
		3)	0.19	0.01	0.58	
	Vitamin E acetate	1)	10.92	148.54	148.54	
		2)	10.45	141.88	141.88	
		3)	10.90	148.26	148.26	
	Vitamin K_1	1)	0.51	1.92	127.82	
		2)	0.50	1.88	125.31	
		3)	0.50	1.88	125.31	

1, 2, and 3 = number of determination

Table e3. Peak area ratio, amount of vitamin and % remaining of oil–soluble vitamins in the emulsions after autoclaving for 48 hours using HPLC technique

Rx	Emulsifiers	Vitamins		Peak Ratio	Amount of vitamins	% Remaining	Figure
B	EPC+T80+PG	Vitamin A palmitate	1)	10.47	22.29	88.76	e2
			2)	9.04	25.41	77.00	
			3)	9.30	26.12	79.15	
		Vitamin D_3	1)	1.40	1.95	93.50	
			2)	1.11	1.48	74.00	
			3)	0.99	1.29	64.50	
		Vitamin E acetate	1)	6.22	81.97	81.97	
			2)	6.32	83.39	83.39	
			3)	6.21	81.83	81.83	
		Vitamin K_1	1)	0.25	0.94	62.47	
			2)	0.26	0.98	65.33	
			3)	0.26	0.98	65.33	
C	EPC+T80+SA	Vitamin A palmitate	1)	7.59	21.48	65.09	e3
			2)	9.24	25.95	78.64	
			3)	9.20	25.85	78.33	
		Vitamin D_3	1)	1.20	1.63	81.50	
			2)	1.24	1.69	84.50	
			3)	1.08	1.44	72.00	
		Vitamin E acetate	1)	6.50	85.93	85.93	
			2)	6.64	87.92	87.92	
			3)	6.68	88.48	88.48	
		Vitamin K_1	1)	0.22	0.83	55.33	
			2)	0.21	0.79	52.67	
			3)	0.23	0.86	57.33	

1, 2, and 3 = number of determination

Table e4. Peak area ratio of oil soluble vitamins found in the emulsions after storage for 2 months analyzed using HPLC technique

Rx	Emulsifiers	Method of sterilization	Vitamins		Peak Ratio	Amount of vitamins	% Remaining	Figure
A	EPC+T80	Filtration	Vitamin A palmitate	1)	7.16	20.31	61.56	e4
				2)	6.67	18.99	57.53	
				3)	6.75	19.20	58.53	
			Vitamin D_3	1)	0.59	0.65	32.58	
				2)	0.55	0.59	29.38	
				3)	0.55	0.59	29.38	
			Vitamin E acetate	1)	8.82	118.80	118.80	
				2)	8.97	120.92	120.92	
				3)	8.81	118.65	118.65	
			Vitamin K_1	1)	0.28	1.05	70.18	
				2)	0.30	1.13	75.19	
				3)	0.28	1.05	70.18	
		Autoclaving	Vitamin A palmitate	1)	5.54	15.92	48.25	e5
				2)	6.66	18.96	57.45	
				3)	6.28	17.93	54.33	
			Vitamin D_3	1)	0.47	0.46	22.98	
				2)	0.47	0.46	22.98	
				3)	0.47	0.46	22.98	
			Vitamin E acetate	1)	8.17	109.59	109.59	
				2)	8.14	109.16	109.11	
				3)	8.21	109.16	110.16	
			Vitamin K_1	1)	0.35	1.32	87.72	
				2)	0.34	1.28	85.21	
				3)	0.34	1.28	85.21	
B	EPC+T80+PG	Filtration	Vitamin A palmitate	1)	6.92	19.66	59.59	e6
				2)	7.43	21.05	63.78	
				3)	7.47	21.16	64.11	
			Vitamin D_3	1)	0.47	0.46	22.98	
				2)	0.50	0.51	25.38	
				3)	0.50	0.51	25.38	
			Vitamin E acetate	1)	8.92	120.06	120.06	
				2)	8.96	120.21	120.21	
				3)	8.98	120.78	120.78	
			Vitamin K1	1)	0.37	1.39	92.73	
				2)	0.67	2.52	167.92	
				3)	0.68	2.56	170.43	

1, 2, and 3 = number of determination

Table e4 (cont.). Peak area ratio of oil soluble vitamins found in the emulsions after storage for 2 months analyzed using HPLC technique

Rx	Emulsifiers	Method of sterilization	Vitamins		Peak Ratio	Amount of vitamins	% Remaining	Figure
B	EPC+T80+PG	Autoclaving	Vitamin A palmitate	1)	5.96	17.06	51.70	e7
				2)	6.78	19.28	58.44	
				3)	6.46	18.24	55.81	
			Vitamin D_3	1)	0.43	0.40	19.78	
				2)	0.45	0.43	21.38	
				3)	0.44	0.41	20.58	
			Vitamin E acetate	1)	7.74	103.50	103.50	
				2)	7.65	102.22	102.22	
				3)	7.77	103.92	103.92	
			Vitamin K_1	1)	0.36	1.35	90.23	
				2)	0.37	1.39	92.73	
				3)	0.40	1.50	100.25	
C	EPC+T80+SA	Filtration	Vitamin A palmitate	1)	5.63	16.17	48.99	e8
				2)	5.57	16.00	48.49	
				3)	5.72	16.41	49.73	
			Vitamin D_3	1)	0.48	0.48	23.78	
				2)	0.47	0.46	22.98	
				3)	0.46	0.44	22.18	
			Vitamin E acetate	1)	7.33	97.69	97.69	
				2)	7.23	96.27	96.27	
				3)	7.19	95.71	95.71	
			Vitamin K_1	1)	0.33	1.24	82.71	
				2)	0.24	0.90	60.15	
				3)	0.23	0.86	57.64	
		Autoclaving	Vitamin A palmitate	1)	5.00	14.46	43.81	e9
				2)	6.06	17.33	52.52	
				3)	6.08	17.39	52.69	
			Vitamin D_3	1)	0.39	0.33	16.58	
				2)	0.52	0.54	26.98	
				3)	0.52	0.54	26.98	
			Vitamin E acetate	1)	7.21	95.99	95.99	
				2)	7.38	98.40	98.40	
				3)	7.18	95.57	95.57	
			Vitamin K_1	1)	0.27	1.02	67.67	
				2)	0.24	0.90	60.15	
				3)	0.27	1.02	67.67	

1, 2, and 3 = number of determination

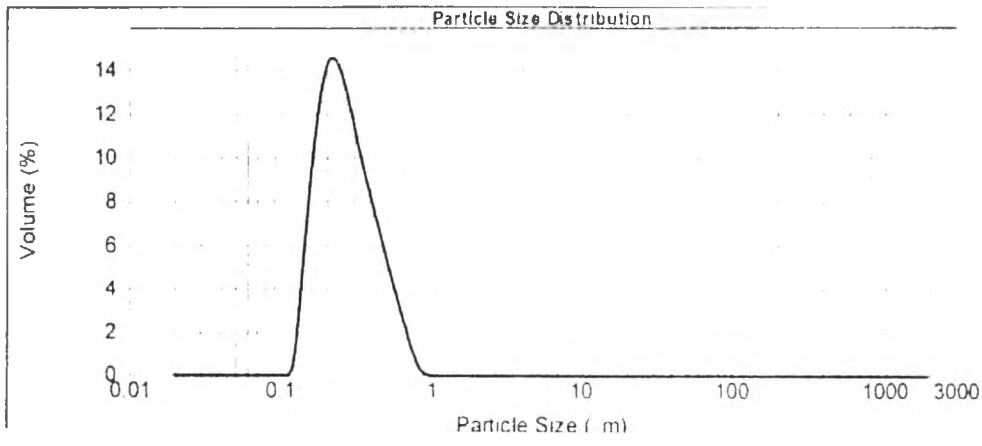

Figure c1. Particle size distribution of commercial product, Intralipid® 10%

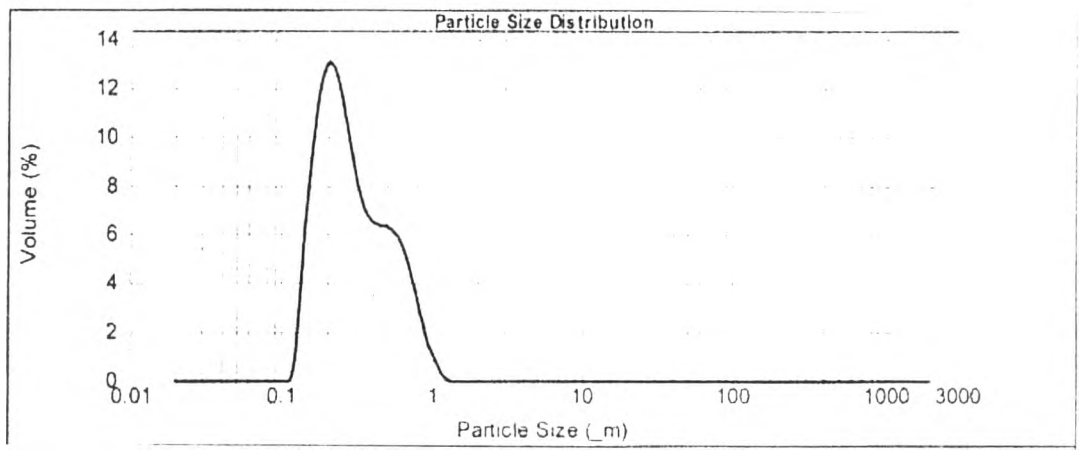

Figure c2. Particle size distribution of commercial product, Intralipid® 20%

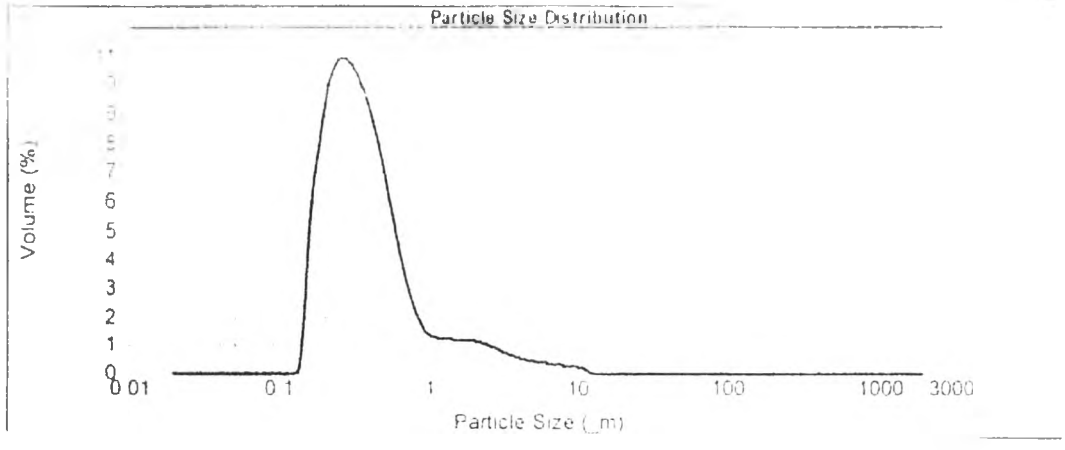

Figure c3. Particle size distribution of commercial product, Vitralipid®

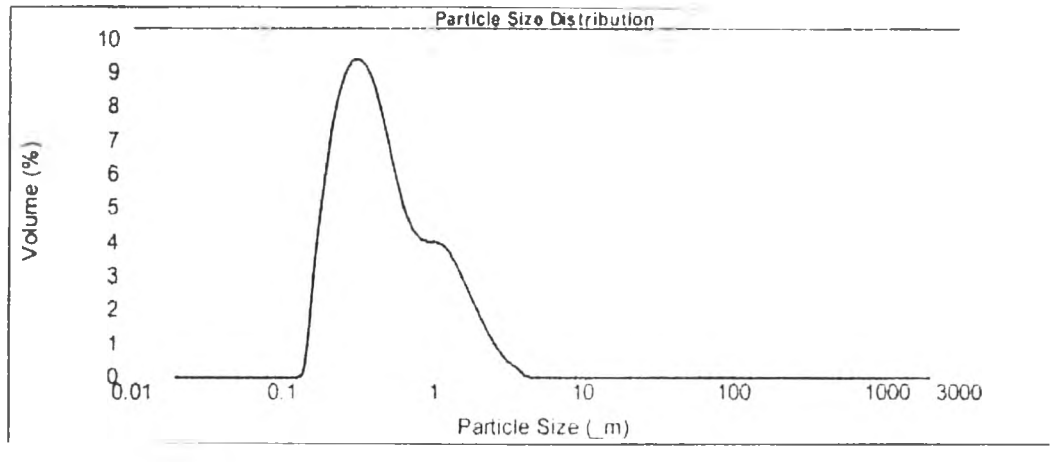

Figure d1. Particle size distribution of 10% bo+EPC unautoclaved emulsion passing homogenizer 3 cycles

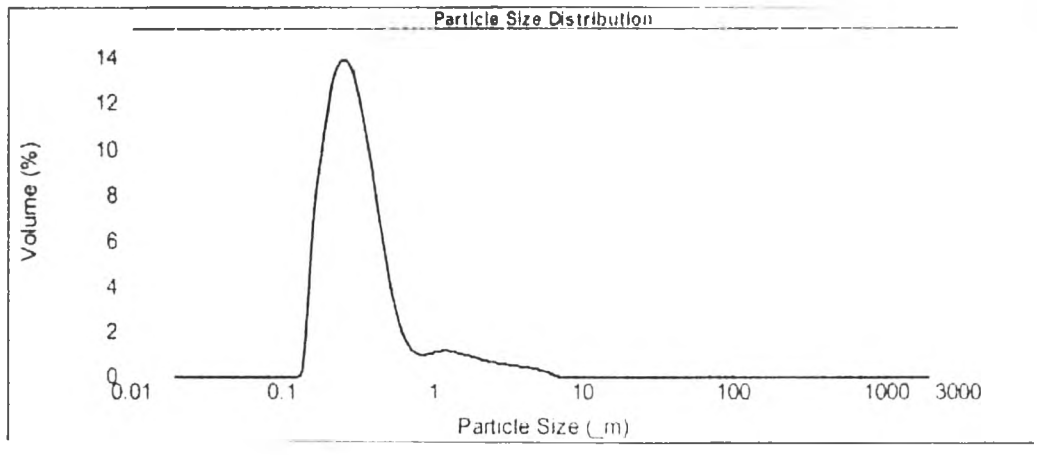

Figure d2. Particle size distribution of 10% bo+EPC unautoclaved emulsion passing homogenizer 5 cycles

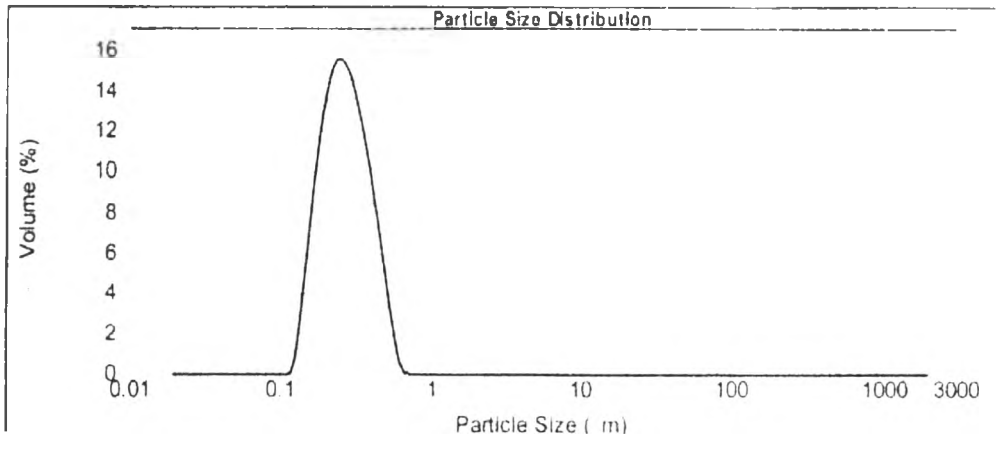

Figure d3. Particle size distribution of 10% bo+EPC unautoclaved emulsion passing homogenizer 7 cycles

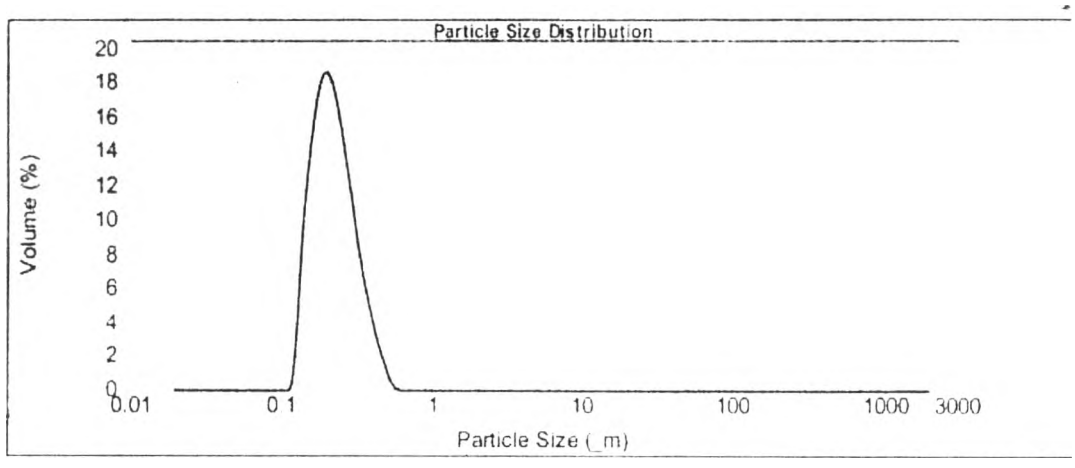

Figure d4. Particle size distribution of 10% bo+EPC unautoclaved emulsion passing homogenizer 10 cycles

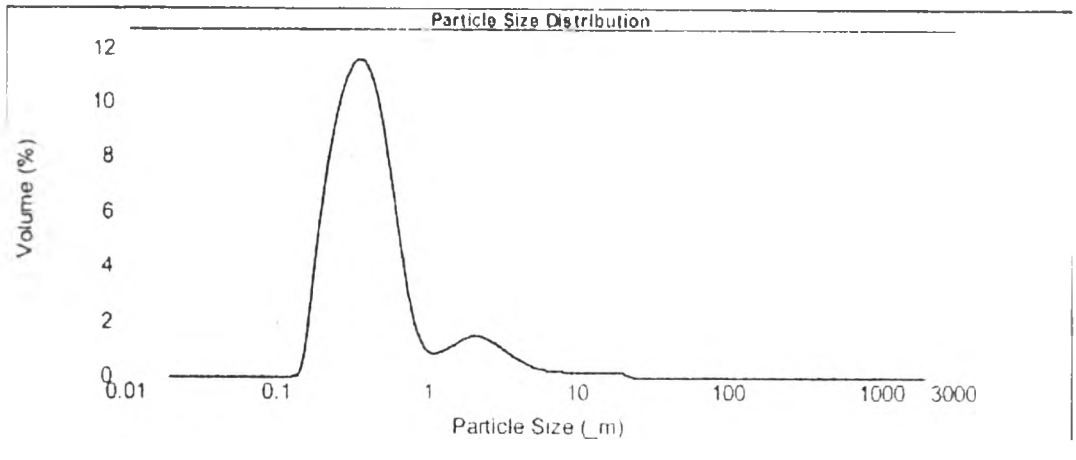

Figure d5. Particle size distribution of 10% bo+EPC autoclaved emulsion passing homogenizer 10 cycles

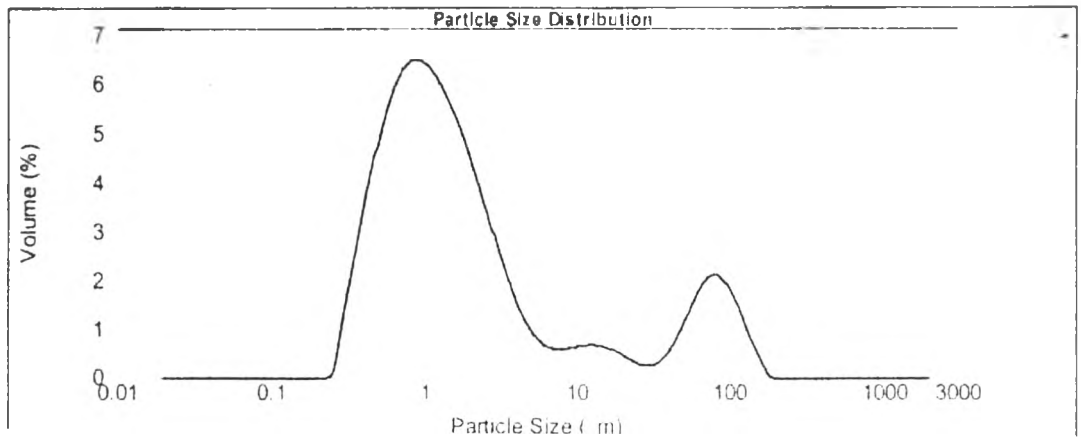

Figure d6. Particle size distribution of 10% bo+EPC+SA unautoclaved emulsion passing homogenizer 3 cycles

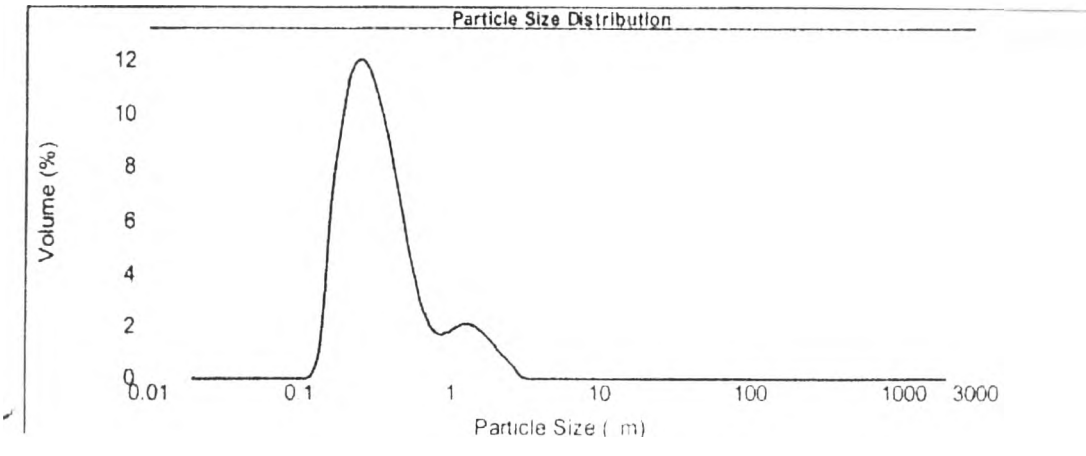

Figure d7. Particle size distribution of 10% bo+EPC+SA unautoclaved emulsion passing homogenizer 5 cycles

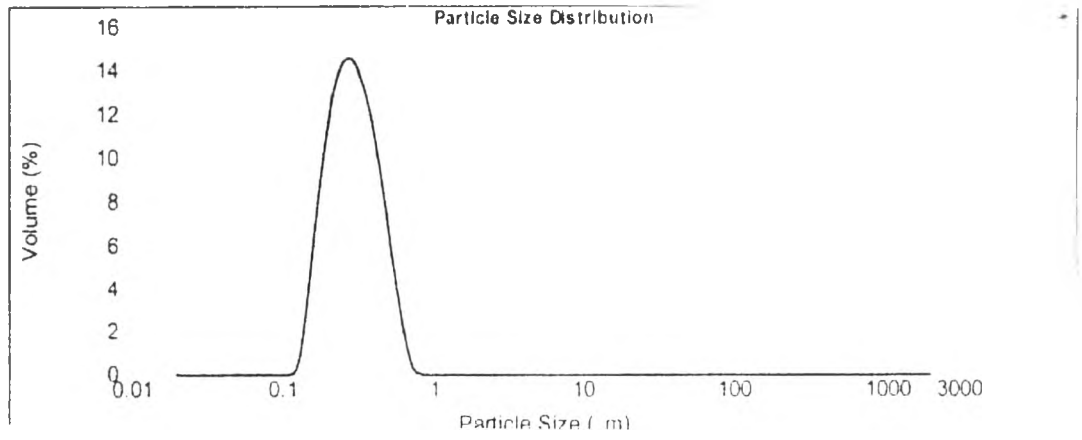

Figure d8. Particle size distribution of 10% bo+EPC+SA unautoclaved emulsion passing homogenizer 7 cycles

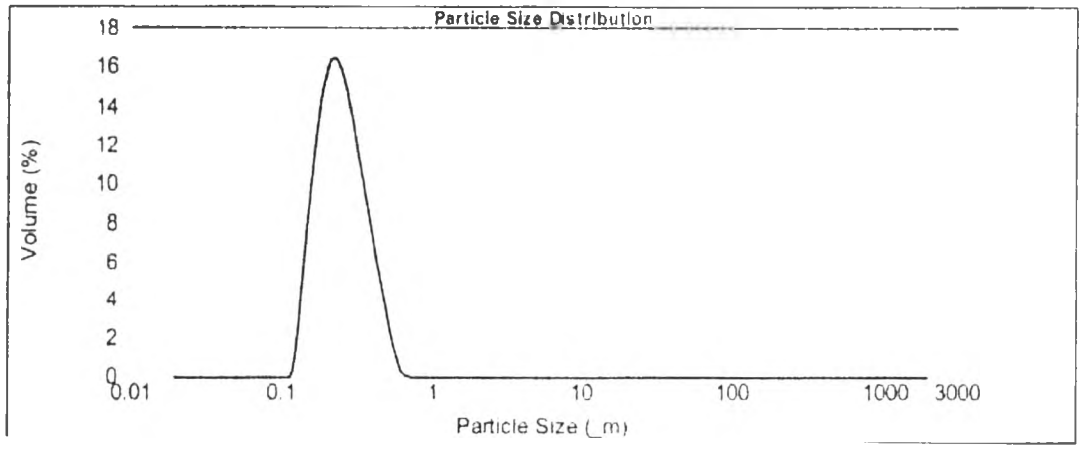

Figure d9. Particle size distribution of 10% bo+EPC+SA unautoclaved emulsion passing homogenizer 10 cycles

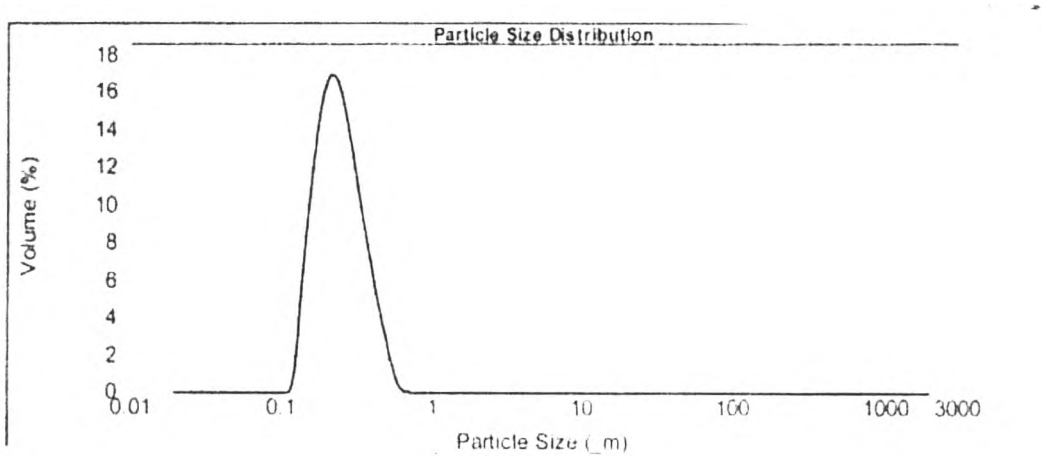

Figure d10. Particle size distribution of 10% bo+EPC+SA autoclaved emulsion passing homogenizer 10 cycles

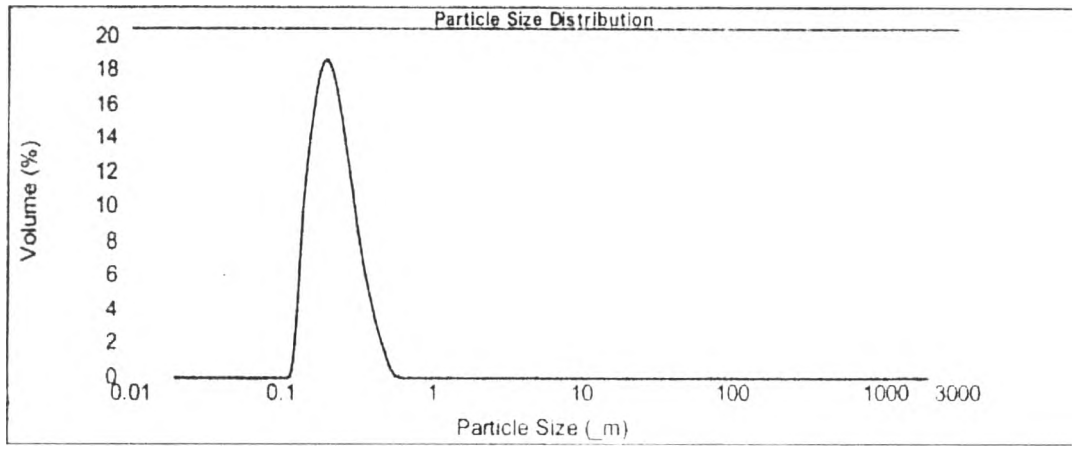

Figure d11. Particle size distribution of 10% bo+EPC unautoclaved emulsion

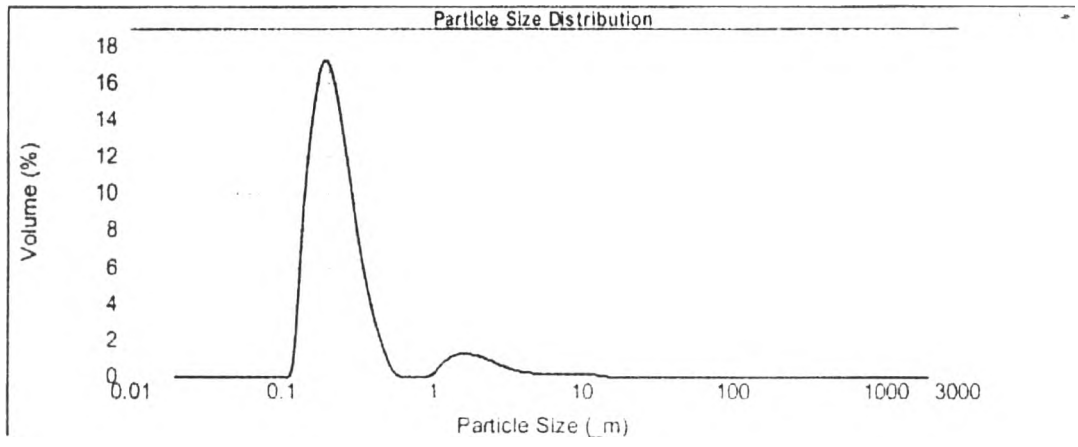

Figure d12. Particle size distribution of 10% bo+EPC unautoclaved emulsion after storage for 6 weeks

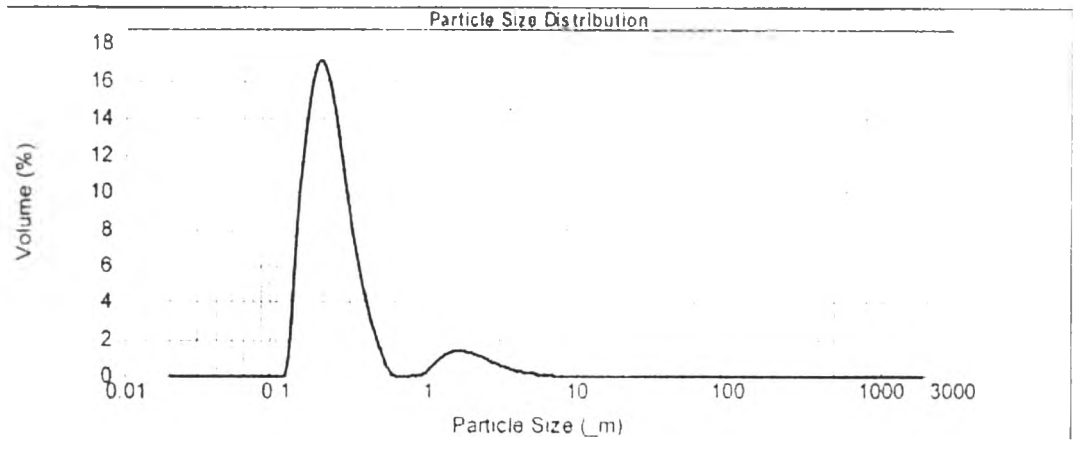

Figure d13. Particle size distribution of 10% bo+EPC unautoclaved emulsion after storage for 8 weeks

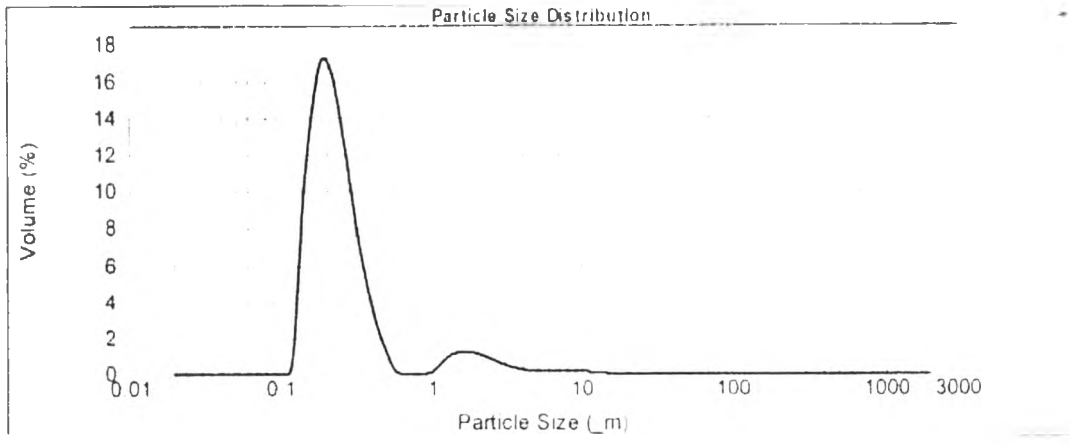

Figure d14. Particle size distribution of 10% bo+EPC unautoclaved emulsion after storage for 16 weeks

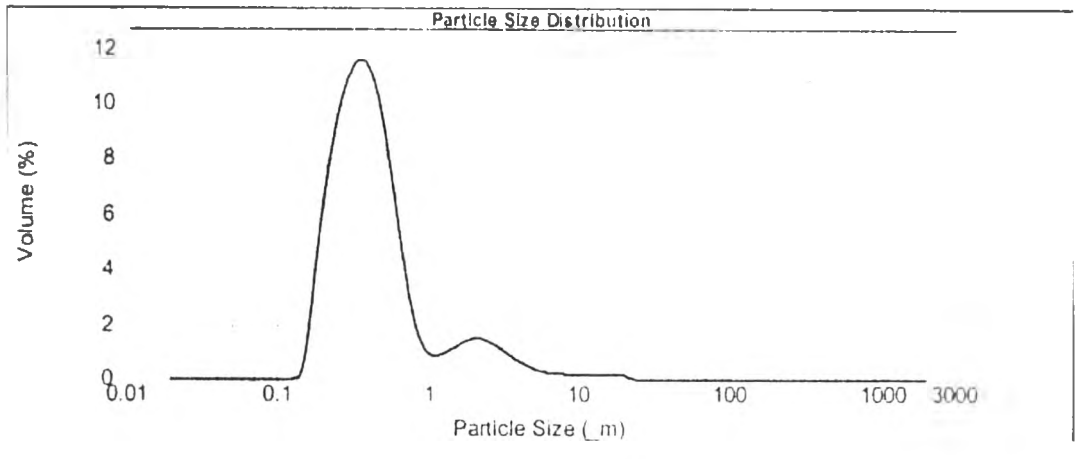

Figure d15. Particle size distribution of 10% bo+EPC autoclaved emulsion

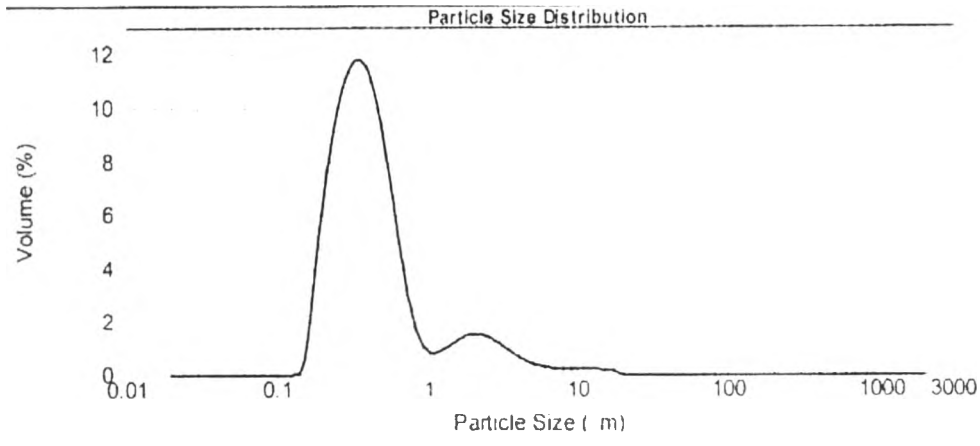

Figure d16. Particle size distribution of 10% bo+EPC autoclaved emulsion after storage for 6 weeks

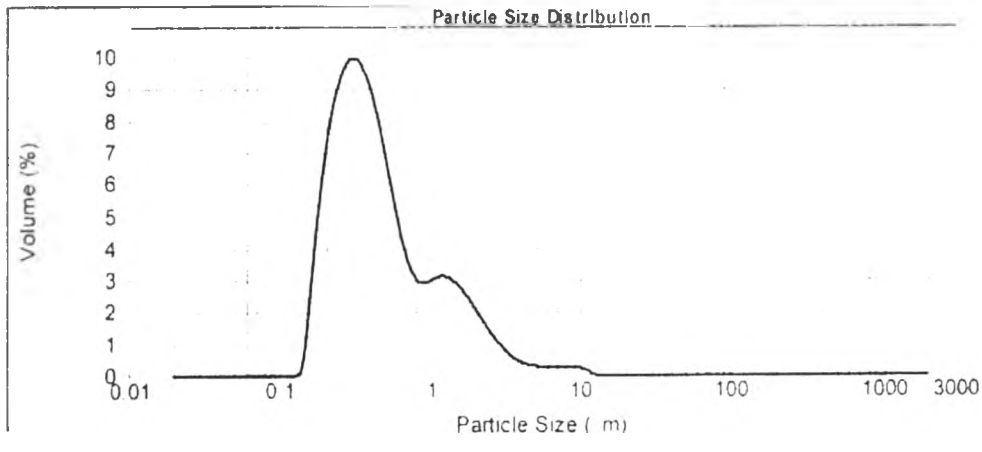

Figure d17. Particle size distribution of 10% bo+EPC autoclaved emulsion after storage for 8 weeks

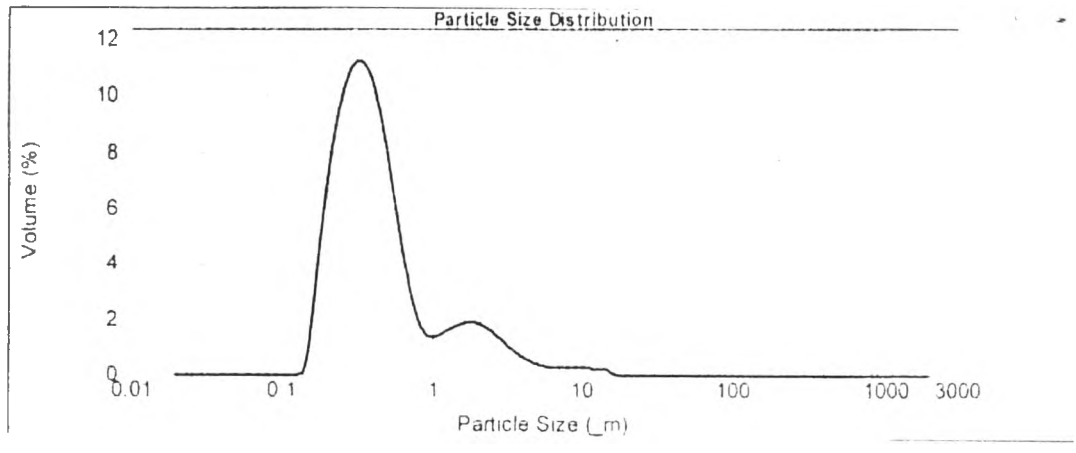

Figure d18. Particle size distribution of 10% bo+EPC autoclaved emulsion after storage for 16 weeks

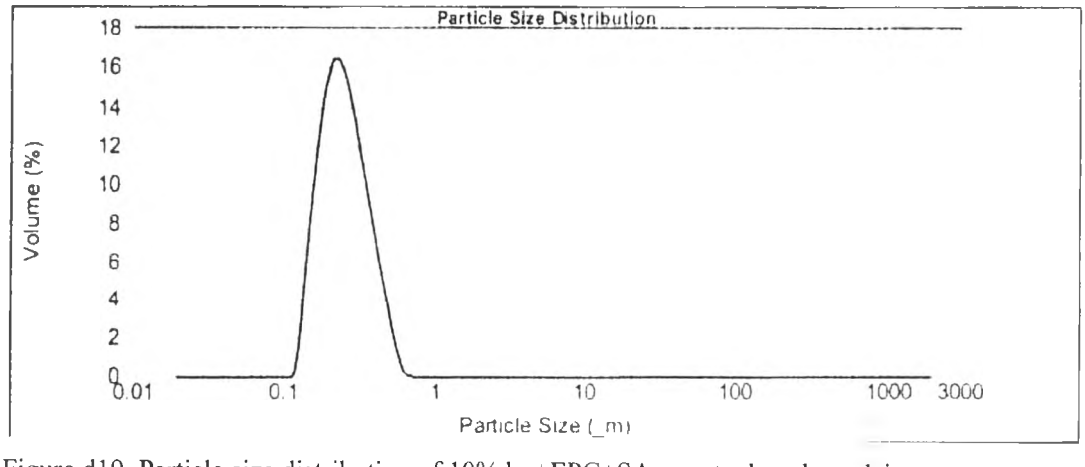

Figure d19. Particle size distribution of 10% bo+EPC+SA unautoclaved emulsion

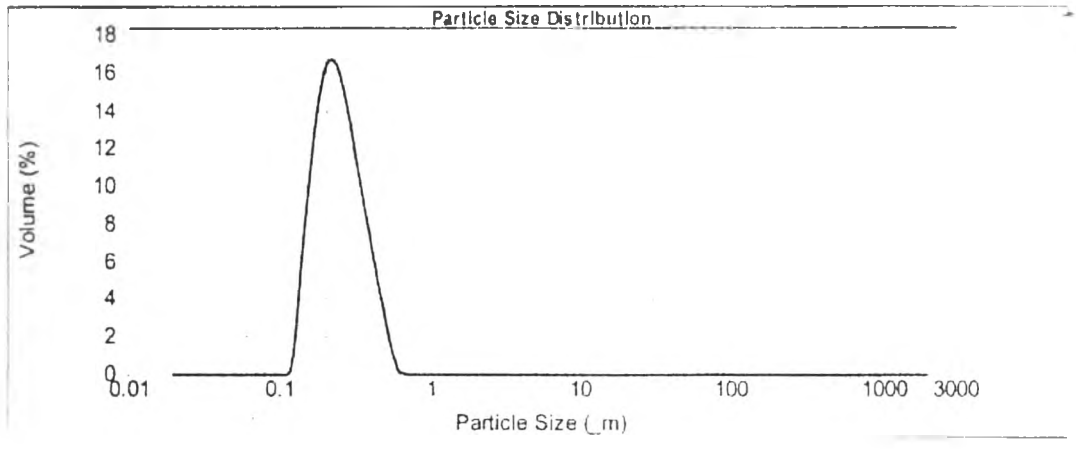

Figure d20. Particle size distribution of 10% bo+EPC+SA unautoclaved emulsion after storage for 6 weeks

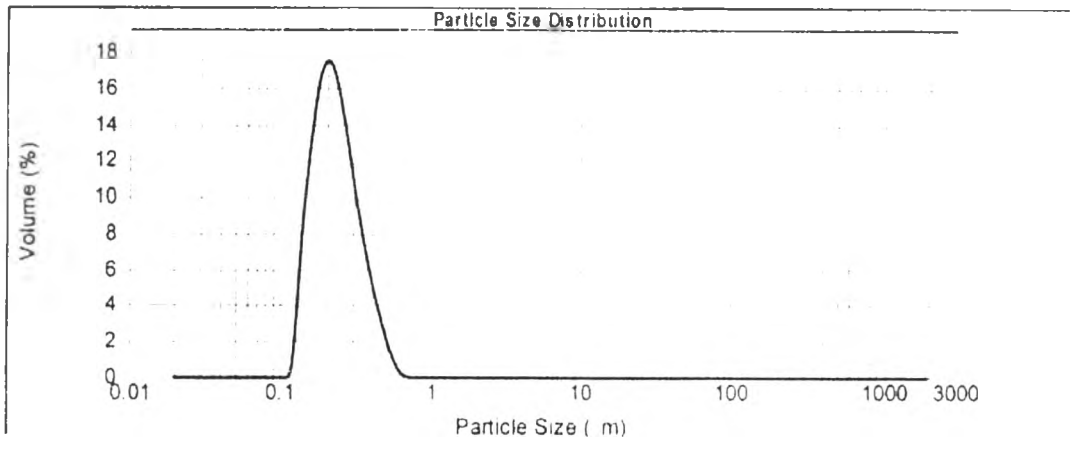

Figure d21. Particle size distribution of 10% bo+EPC+SA unautoclaved emulsion after storage for 8 weeks

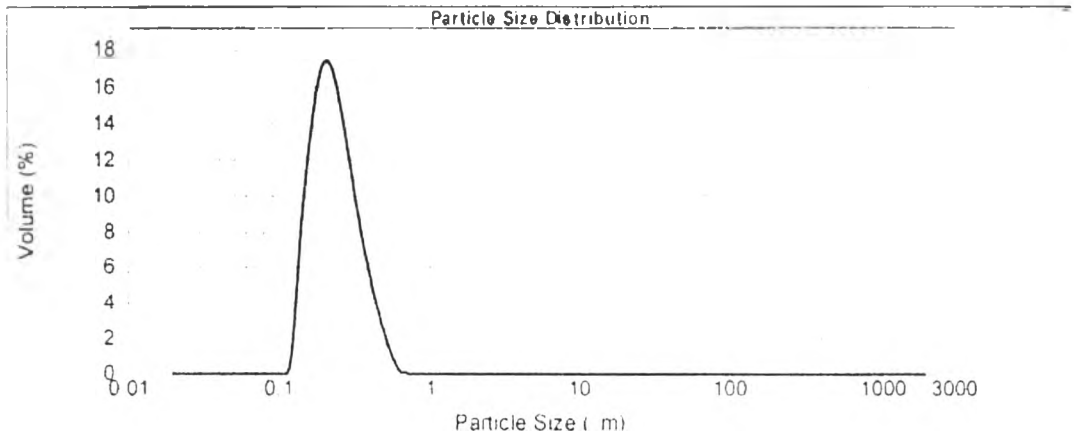

Figure d22. Particle size distribution of 10% bo+EPC+SA unautoclaved emulsion after storage for 16 weeks

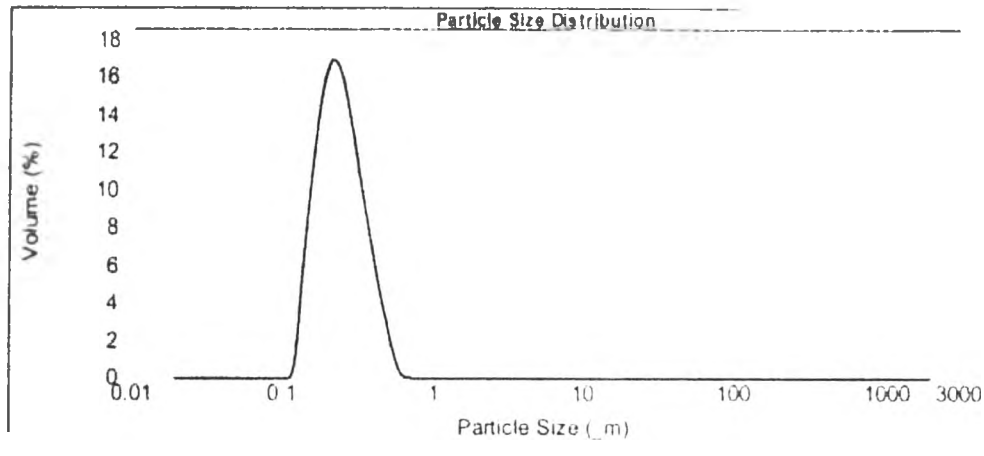

Figure d23. Particle size distribution of 10% bo+EPC+SA autoclaved emulsion

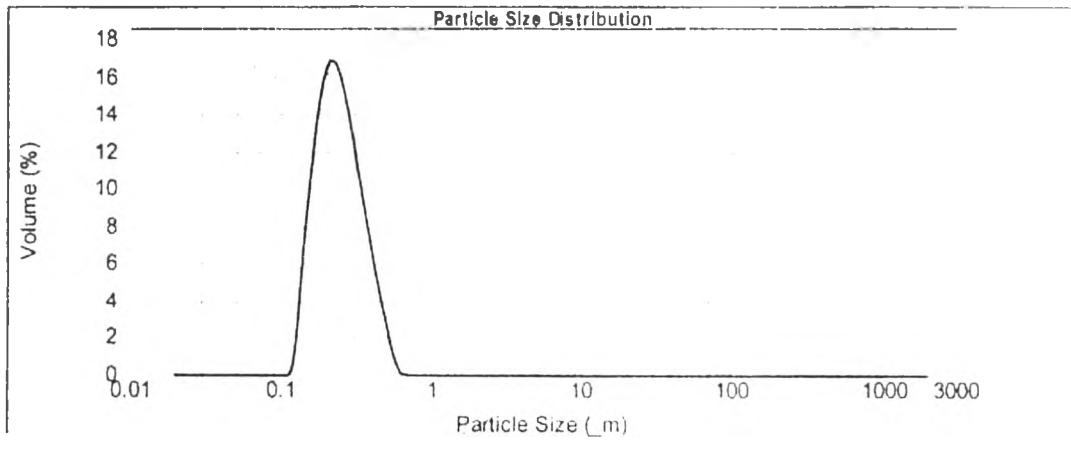

Figure d24. Particle size distribution of 10% bo+EPC+SA autoclaved emulsion after storage for 6 weeks

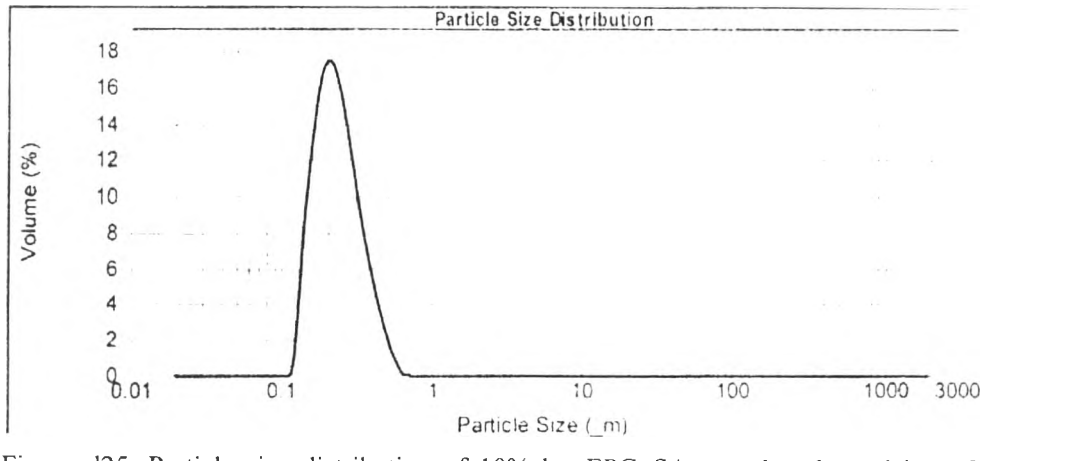

Figure d25. Particle size distribution of 10% bo+EPC+SA autoclaved emulsion after storage for 8 weeks

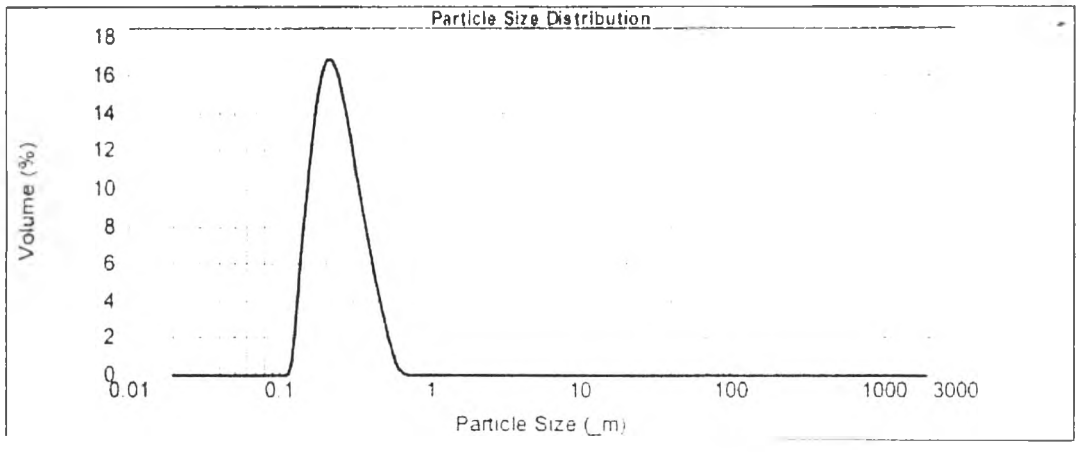

Figure d26. Particle size distribution of 10% bo+EPC+SA autoclaved emulsion after storage for 16 weeks

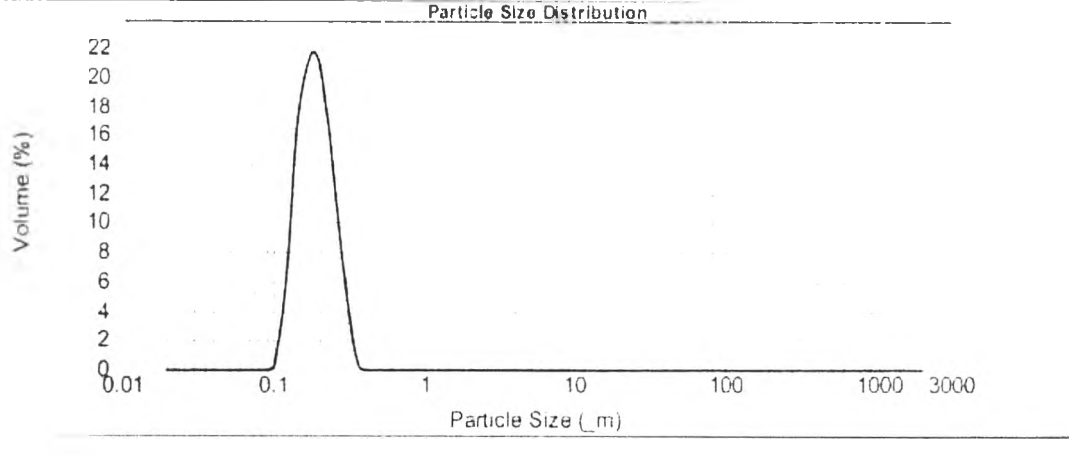

Figure d27. Particle size distribution of 10% bo+EPC+T80 unautoclaved emulsion

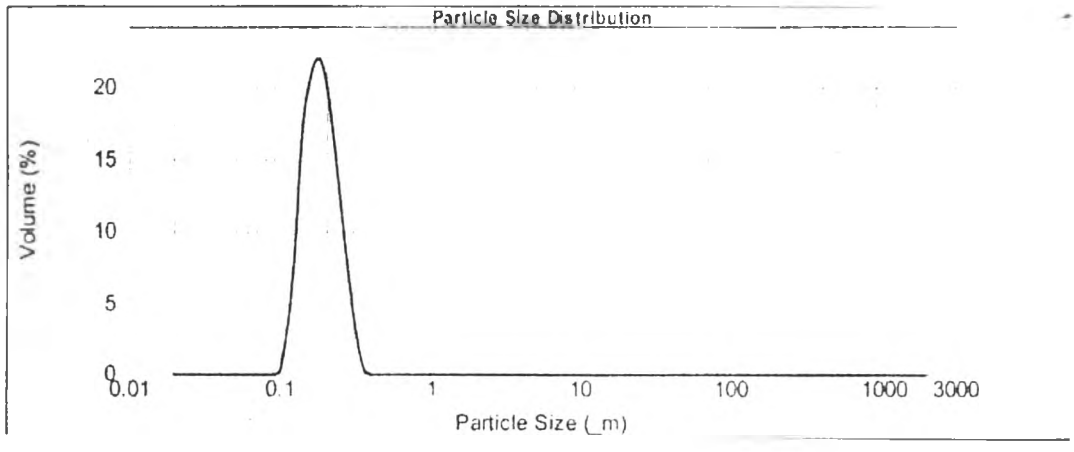

Figure d28. Particle size distribution of 10% bo+EPC+T80 unautoclaved emulsion after storage for 1 week

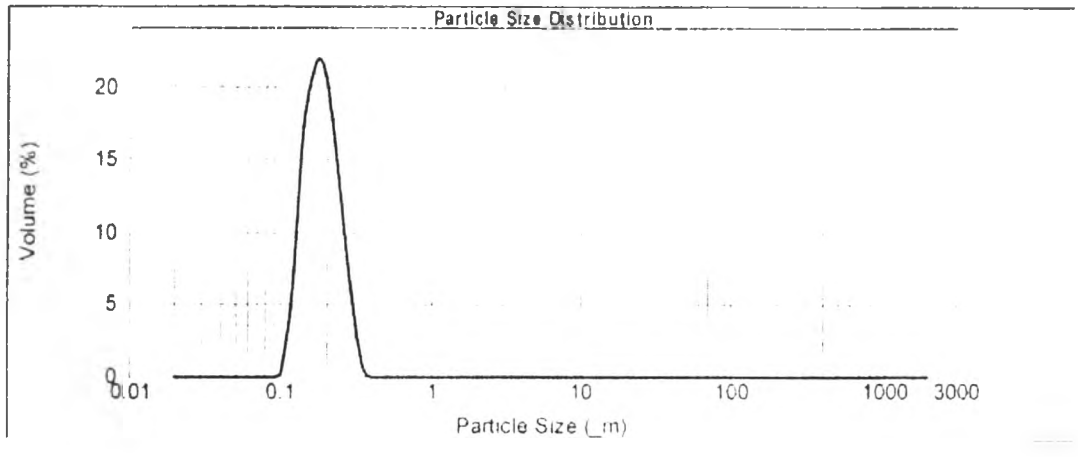

Figure d29. Particle size distribution of 10% bo+EPC+T80 unautoclaved emulsion after storage for 4 weeks

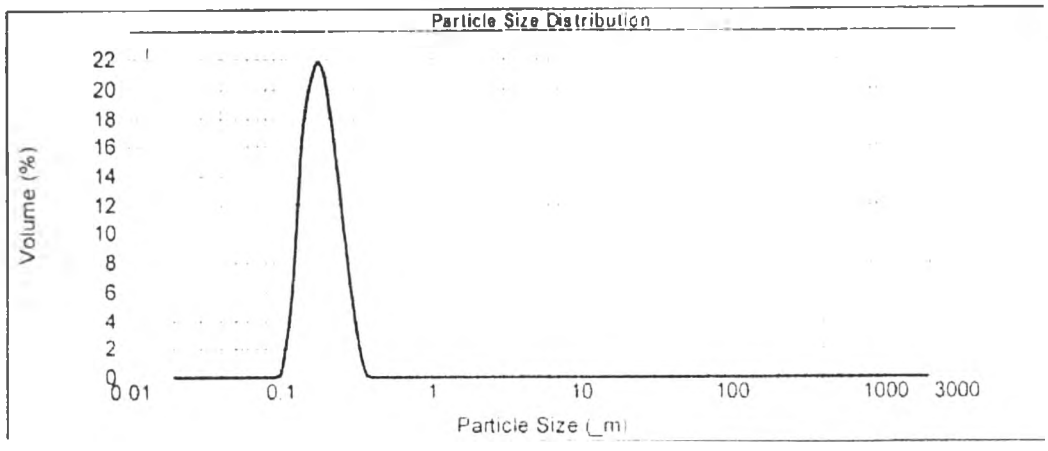

Figure d30. Particle size distribution of 10% bo+EPC+T80 unautoclaved emulsion after storage for 12 weeks

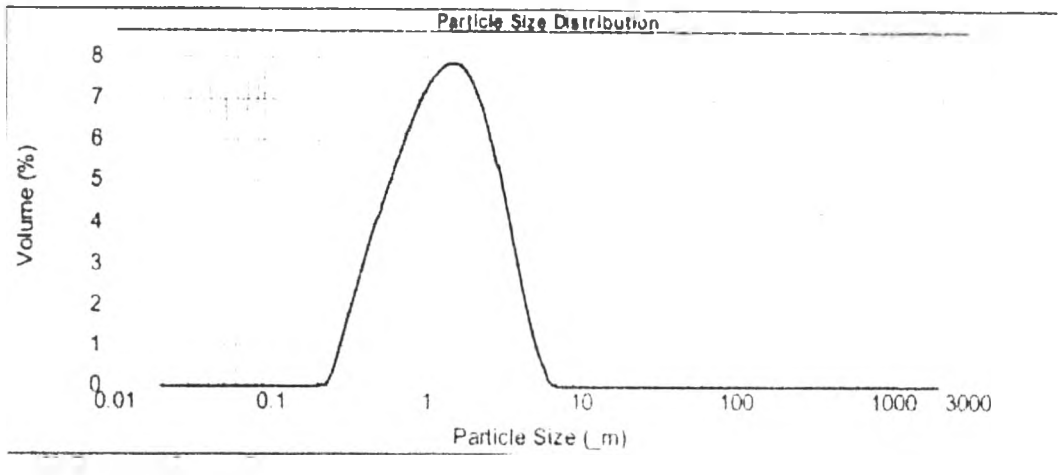

Figure d31. Particle size distribution of 10% bo+EPC+T80 autoclaved emulsion

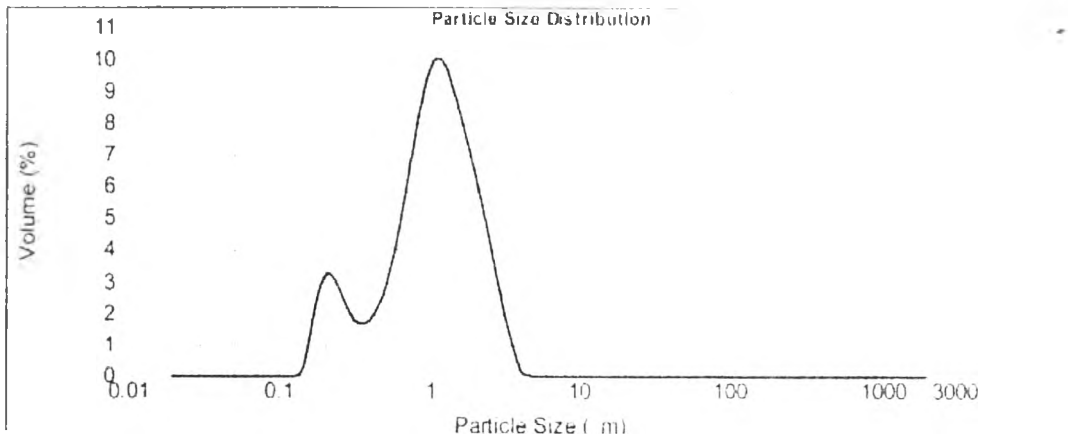

Figure d32. Particle size distribution of 10% bo+EPC+T80 autoclaved emulsion after storage for 1 week

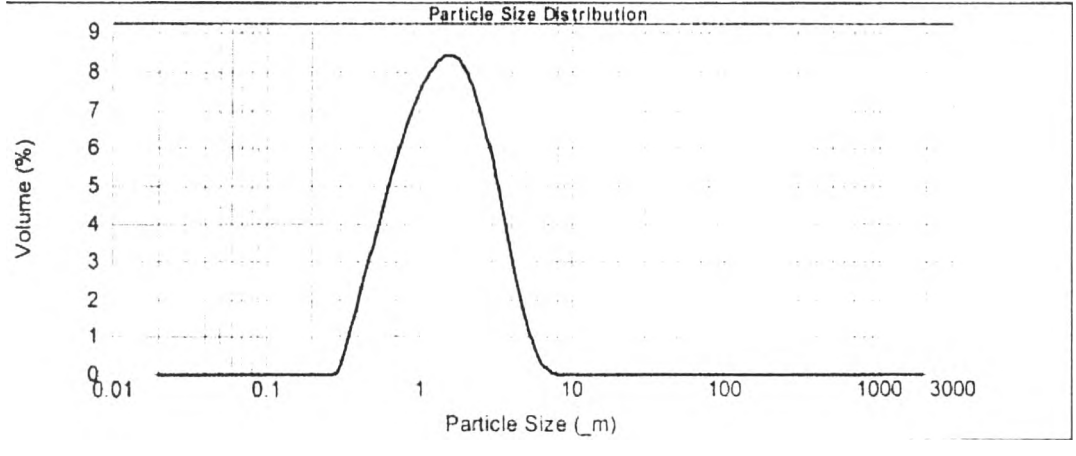

Figure d33. Particle size distribution of 10% bo+EPC+T80 autoclaved emulsion after storage for 4 weeks

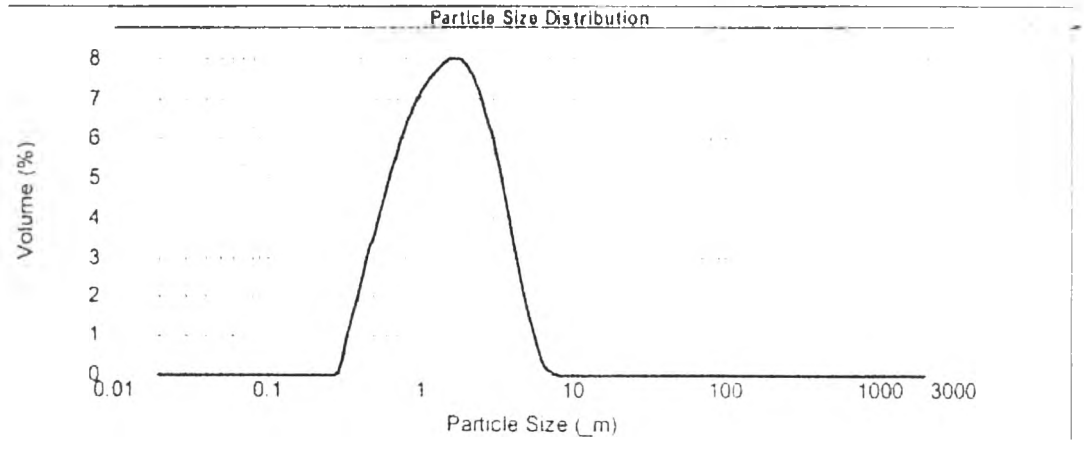

Figure d34. Particle size distribution of 10% bo+EPC+T80 autoclaved emulsion after storage for 12 weeks

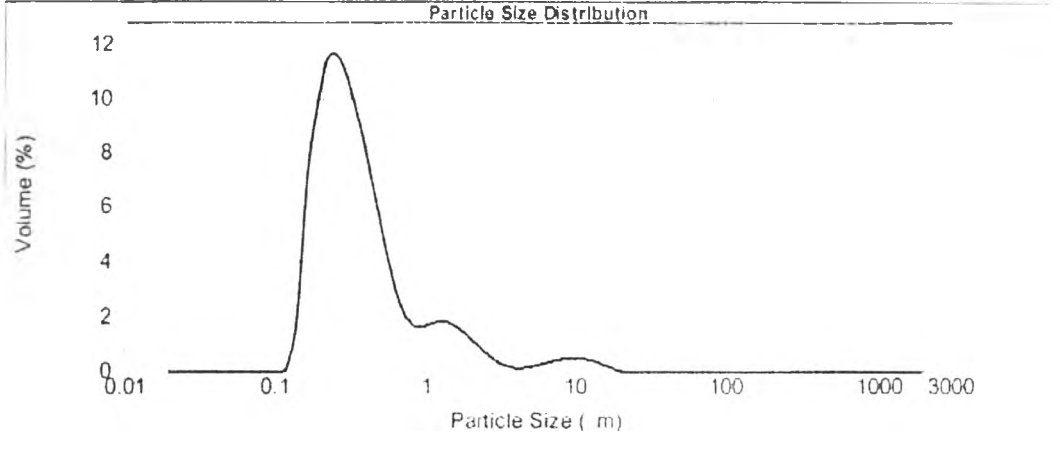

Figure d35. Particle size distribution of 10% bo+EPC+PG unautoclaved emulsion

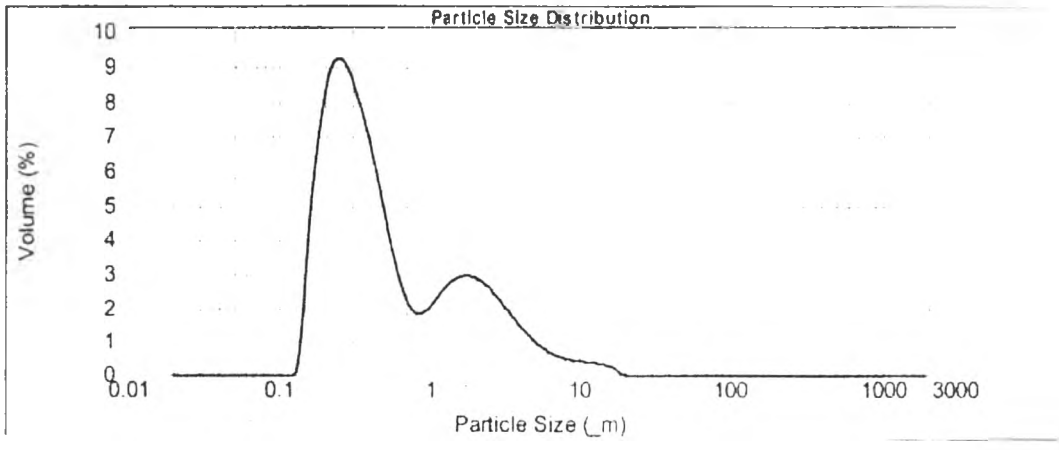

Figure d36. Particle size distribution of 10% bo+EPC+PG unautoclaved emulsion after storage for 1 week

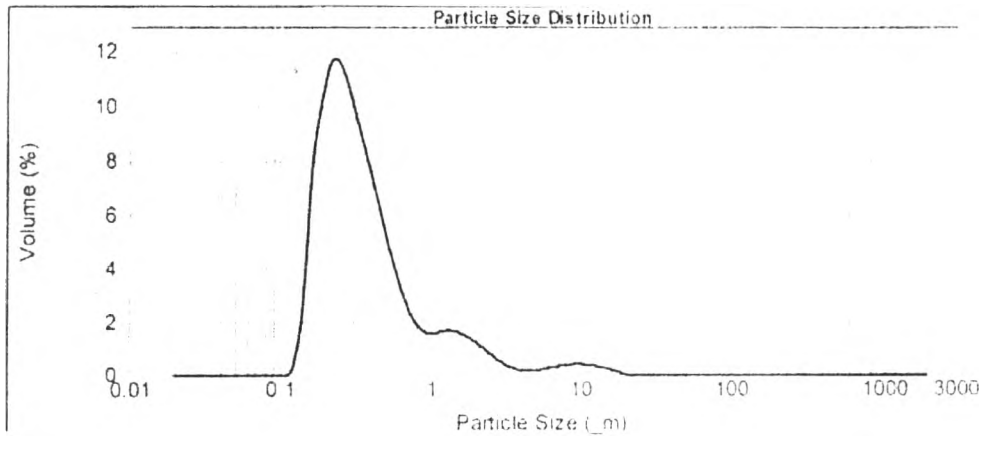

Figure d37. Particle size distribution of 10% bo+EPC+PG unautoclaved emulsion after storage for 4 weeks

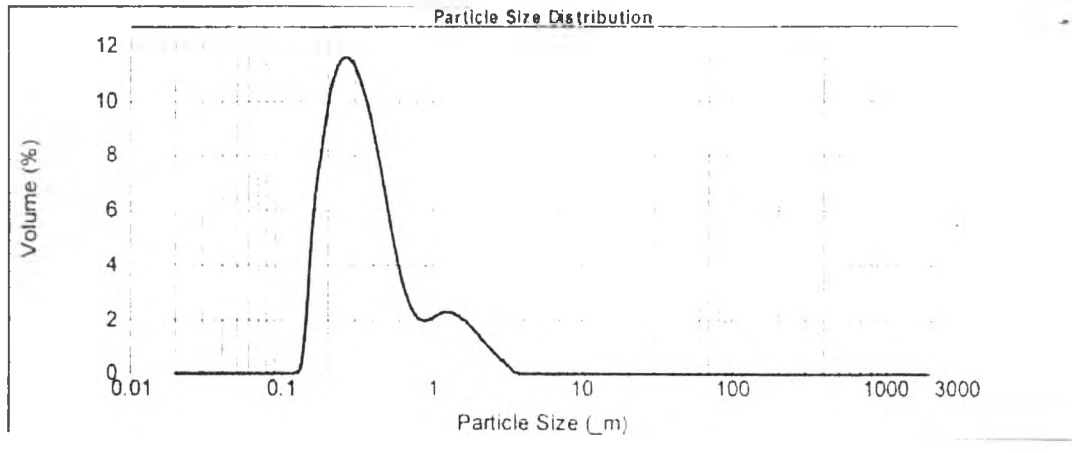

Figure d38. Particle size distribution of 10% bo+EPC+PG unautoclaved emulsion after storage for 11 weeks

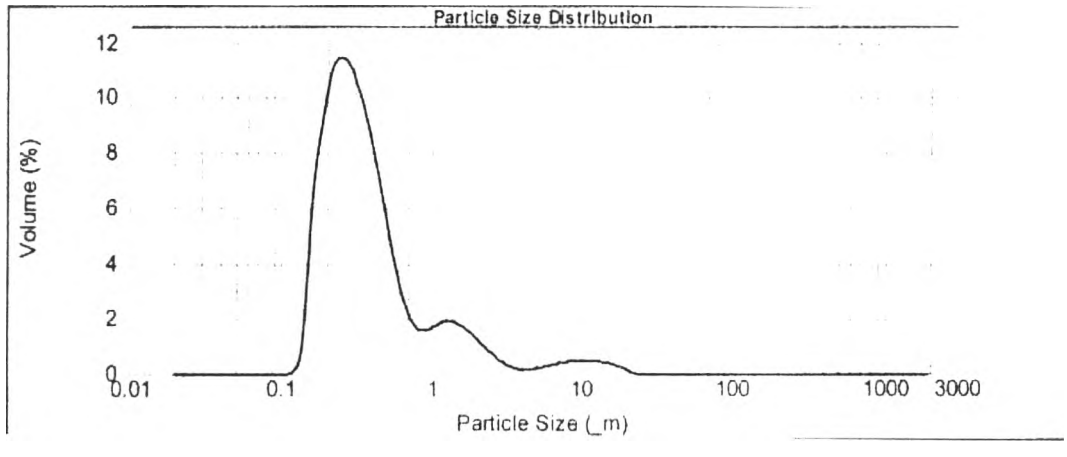

Figure d39. Particle size distribution of 10% bo+EPC+PG autoclaved emulsion

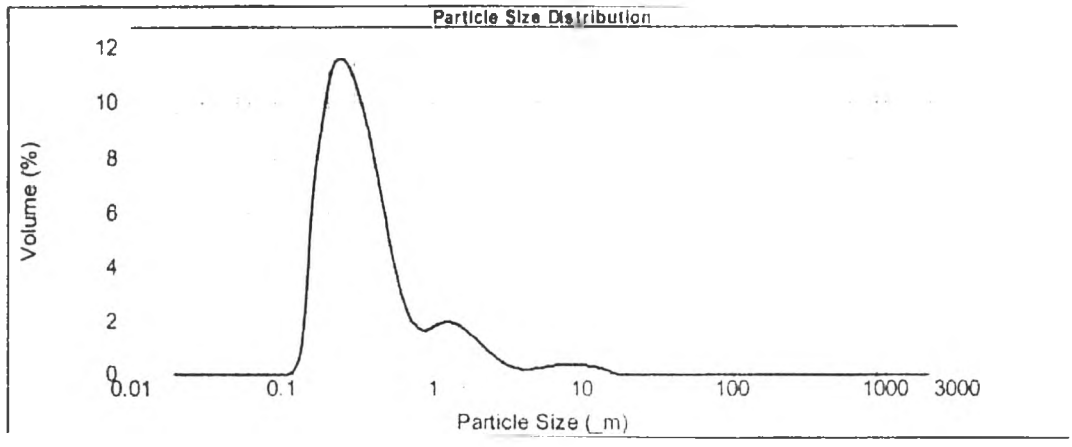

Figure d40. Particle size distribution of 10% bo+EPC+PG autoclaved emulsion after storage for 1 week

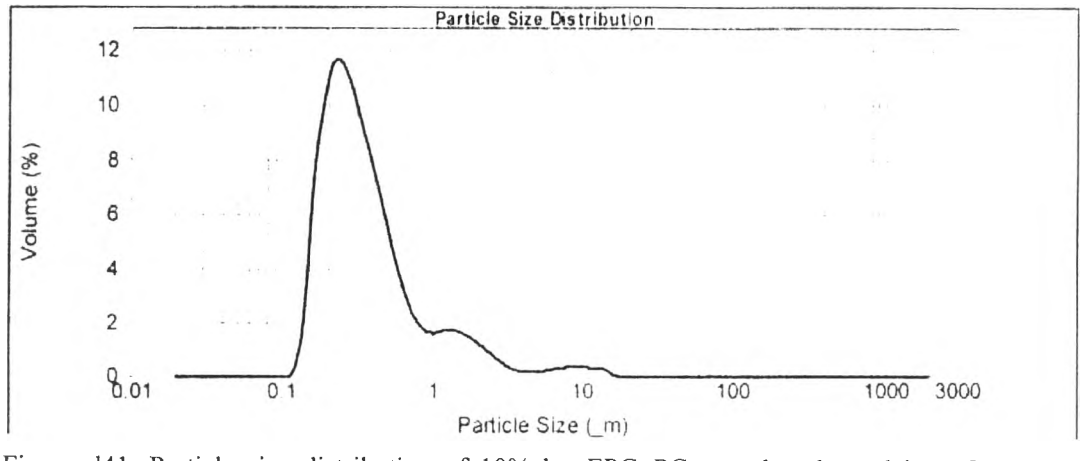

Figure d41. Particle size distribution of 10% bo+EPC+PG autoclaved emulsion after storage for 4 weeks

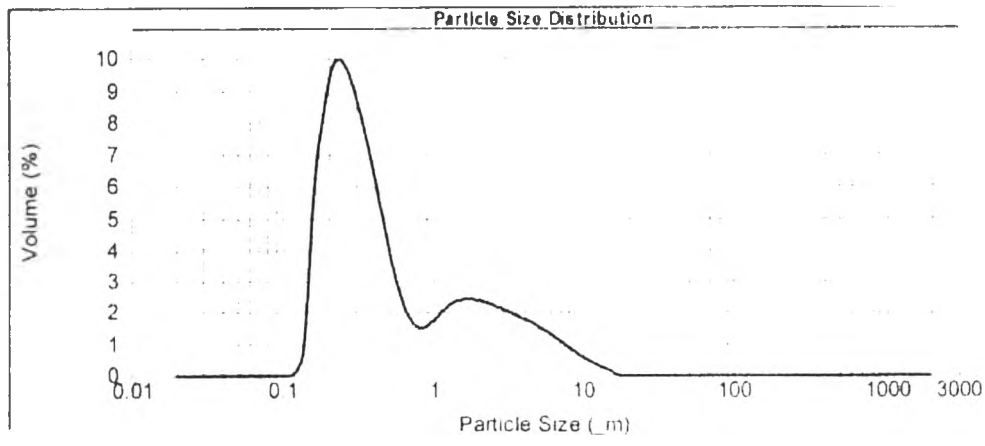

Figure d42. Particle size distribution of 10% bo+EPC+PG autoclaved emulsion after storage for 11 weeks

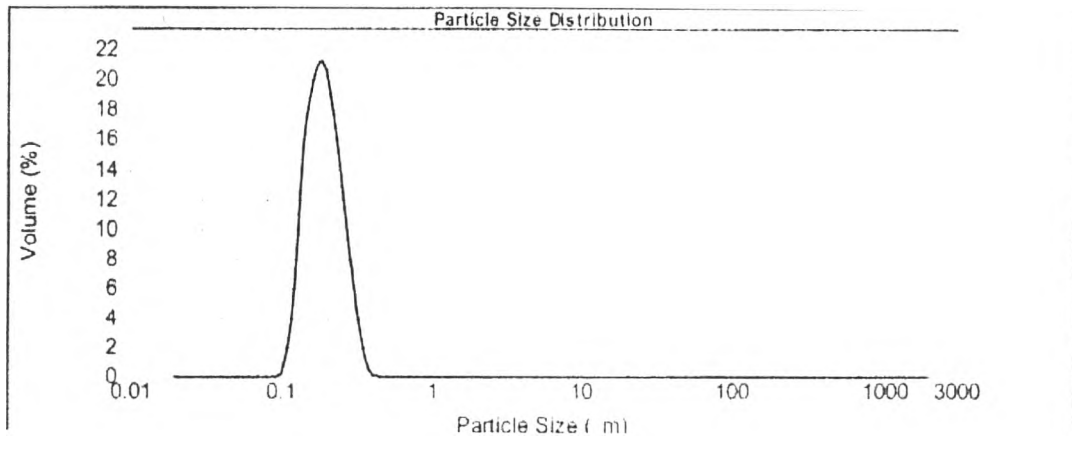

Figure d43. Particle size distribution of 10% bo+EPC+T80+SA unautoclaved emulsion

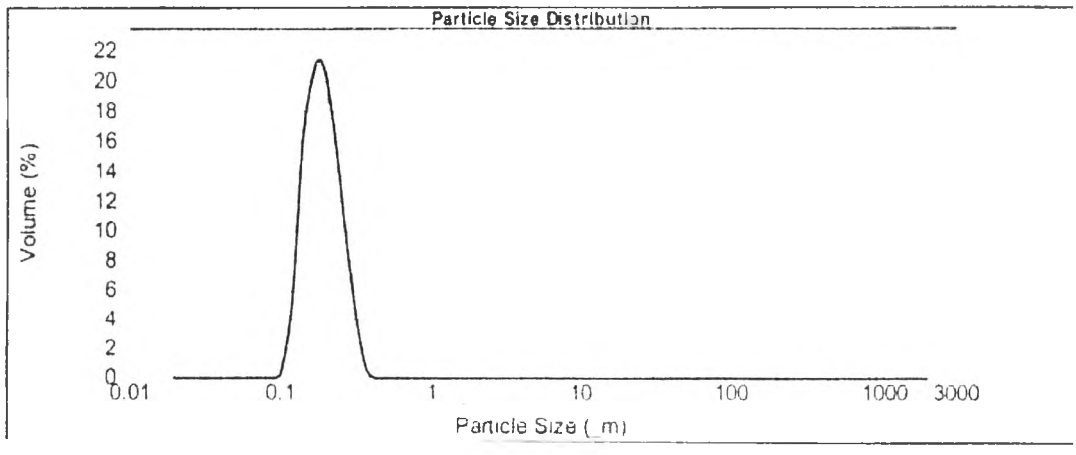

Figure d44. Particle size distribution of 10% bo+EPC+T80+SA unautoclaved emulsion after storage for 1 week

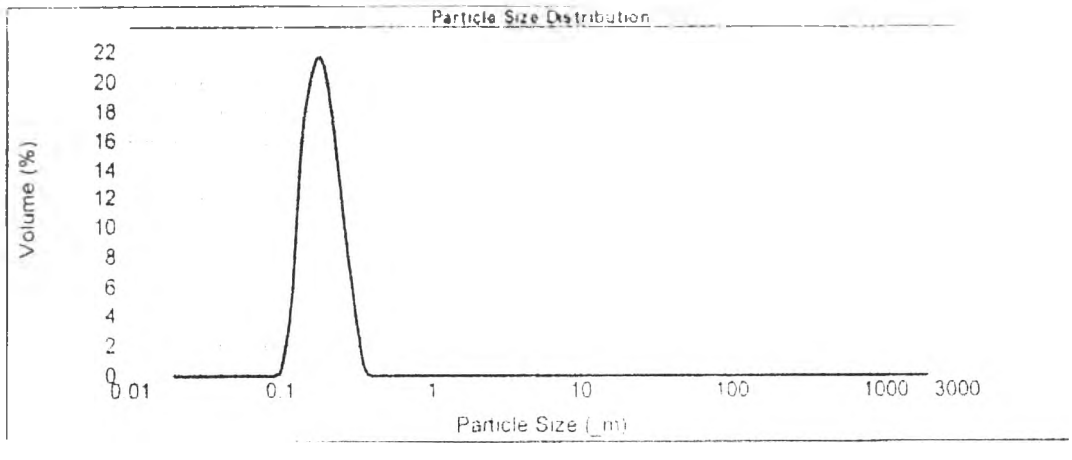

Figure d45. Particle size distribution of 10% bo+EPC+T80+SA unautoclaved emulsion after storage for 4 weeks

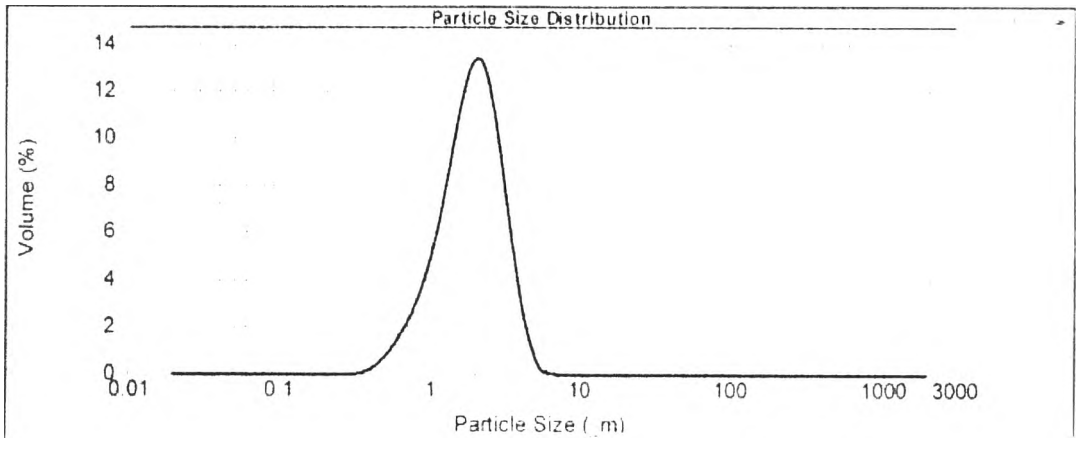

Figure d46. Particle size distribution of 10% bo+EPC+T80+SA unautoclaved emulsion after storage for 10 weeks

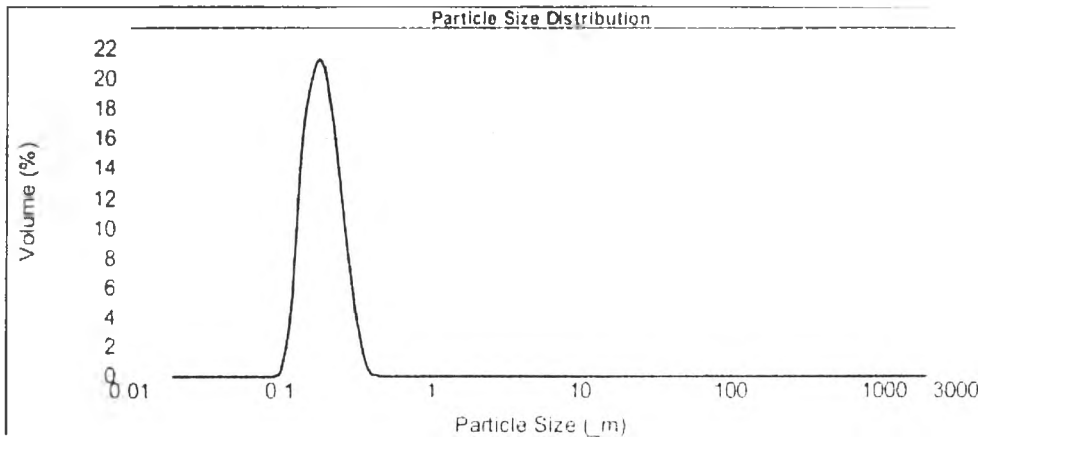

Figure d47. Particle size distribution of 10% bo+EPC+T80+SA autoclaved emulsion

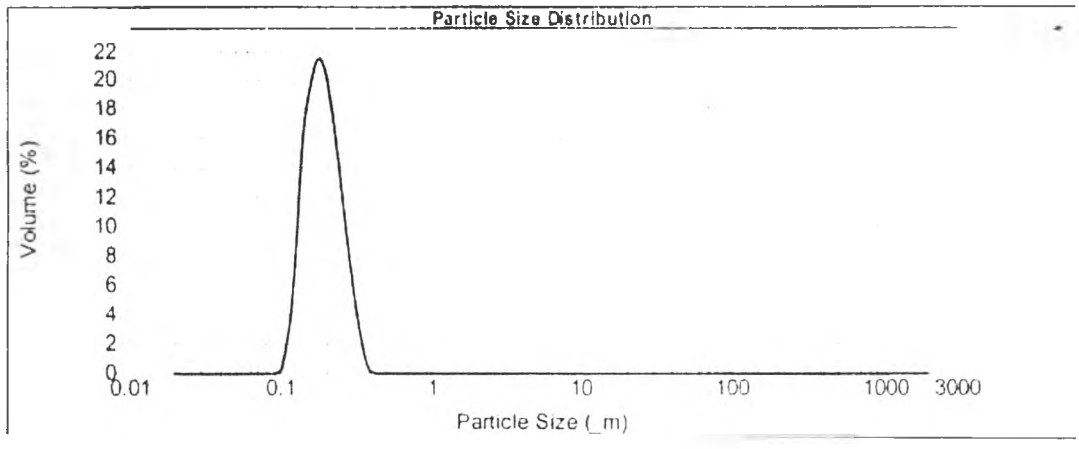

Figure d48. Particle size distribution of 10% bo+EPC+T80+SA autoclaved emulsion after storage for 1 week

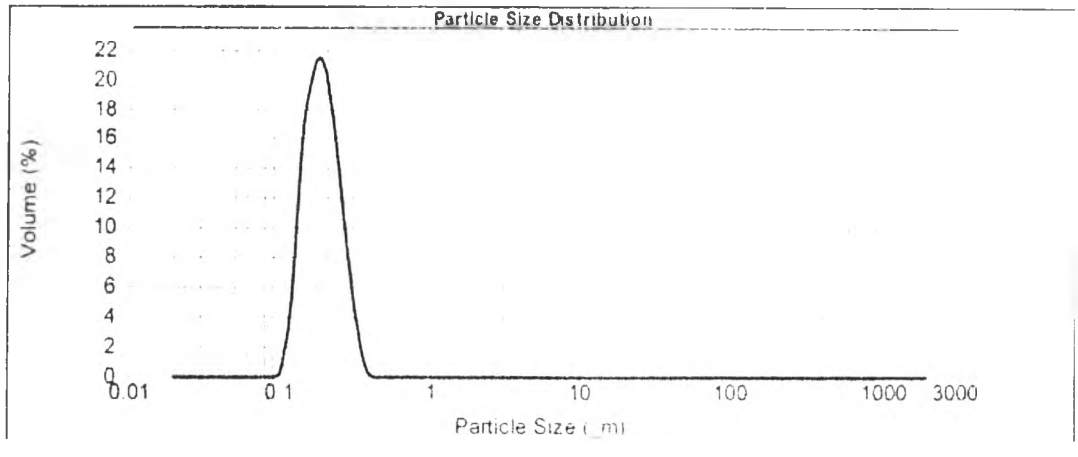

Figure d49. Particle size distribution of 10% bo+EPC+T80+SA autoclaved emulsion after storage for 4 weeks

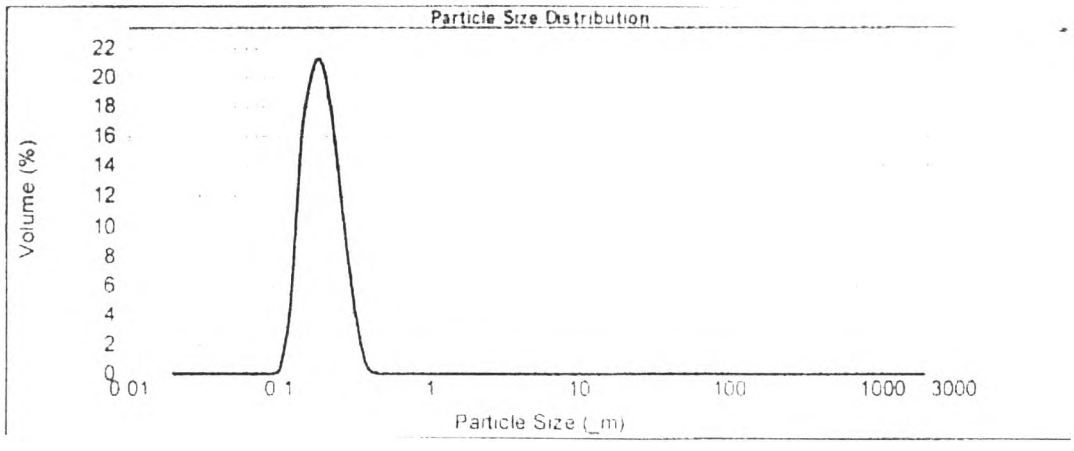

Figure d50. Particle size distribution of 10% bo+EPC+T80+SA autoclaved emulsion after storage for 10 weeks

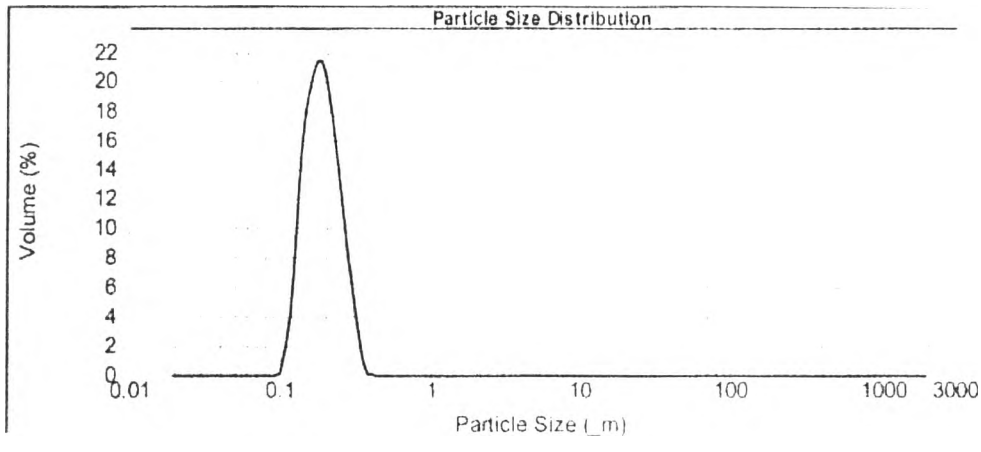

Figure d51. Particle size distribution of 10% bo+SPC+T80+SA unautoclaved emulsion

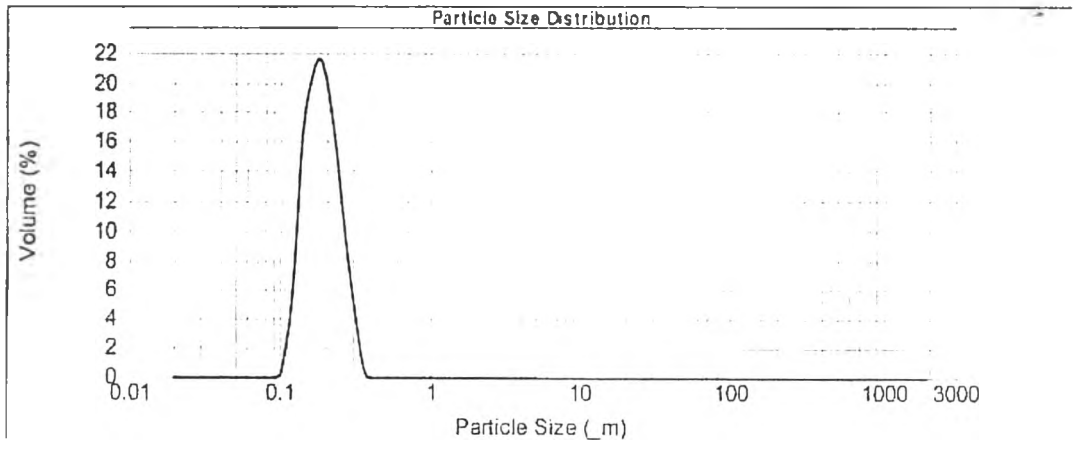

Figure d52. Particle size distribution of 10% bo+SPC+T80+SA unautoclaved emulsion after storage for 1 week

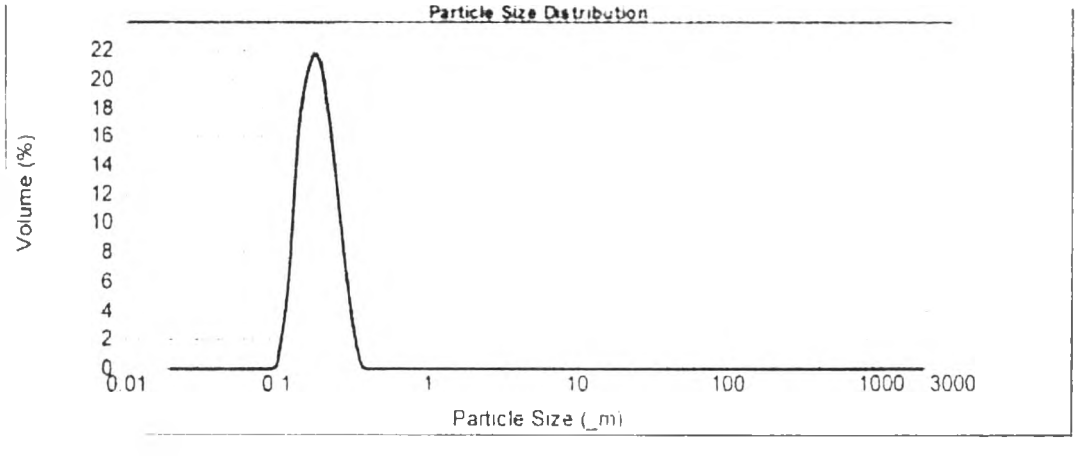

Figure d53. Particle size distribution of 10% bo+SPC+T80+SA unautoclaved emulsion after storage for 4 weeks

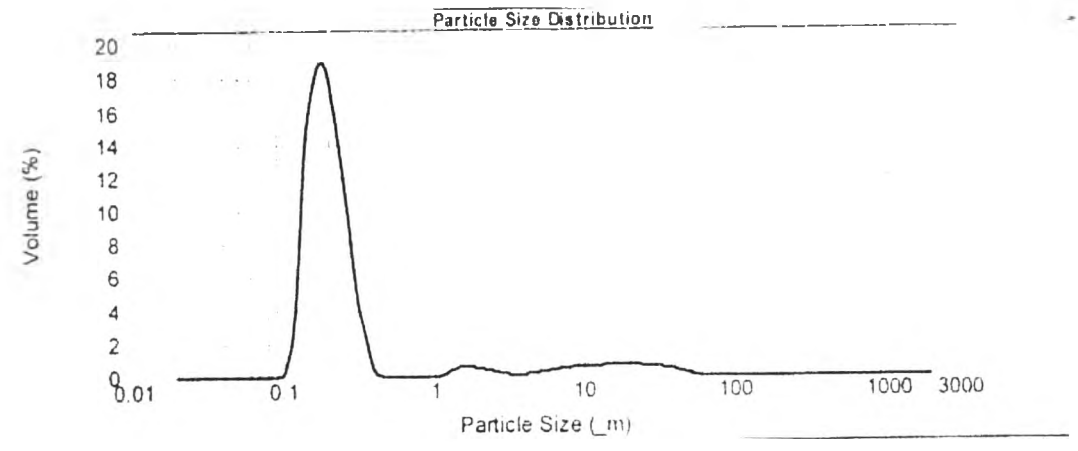

Figure d54. Particle size distribution of 10% bo+SPC+T80+SA unautoclaved emulsion after storage for 10 weeks

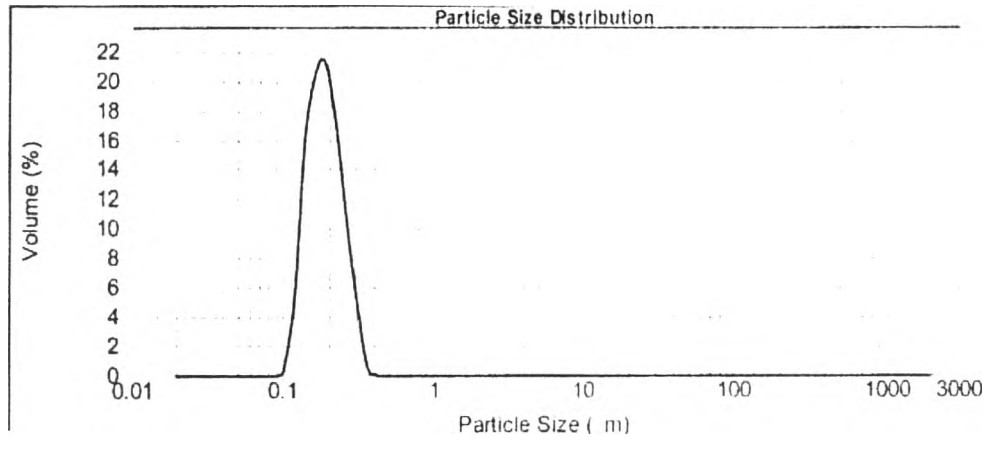

Figure d55. Particle size distribution of 10% bo+SPC+T80+SA autoclaved emulsion

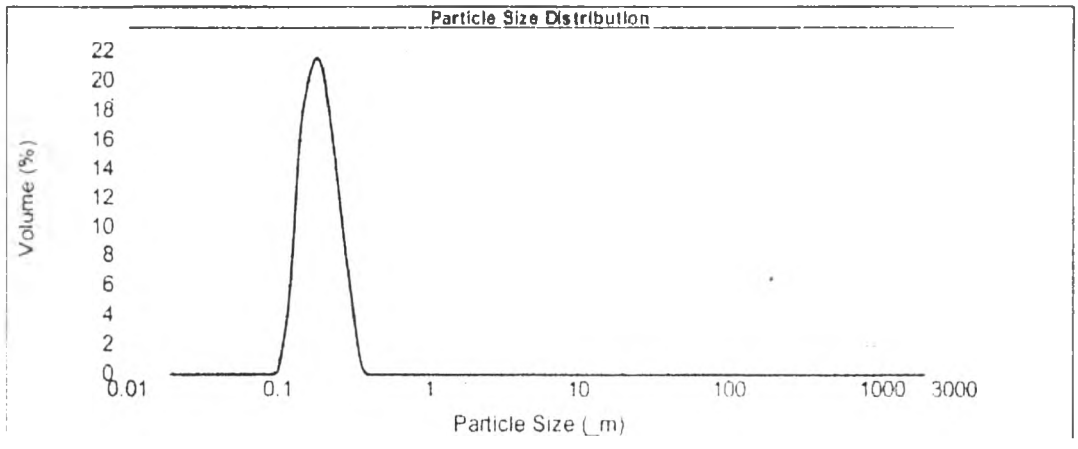

Figure d56. Particle size distribution of 10% bo+SPC+T80+SA autoclaved emulsion after storage for 1 week

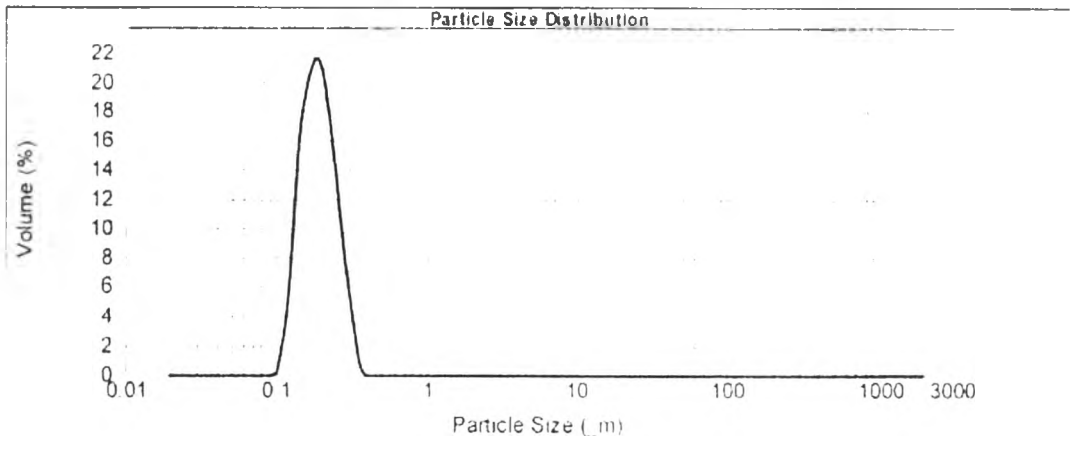

Figure d57. Particle size distribution of 10% bo+SPC+T80+SA autoclaved emulsion after storage for 4 weeks

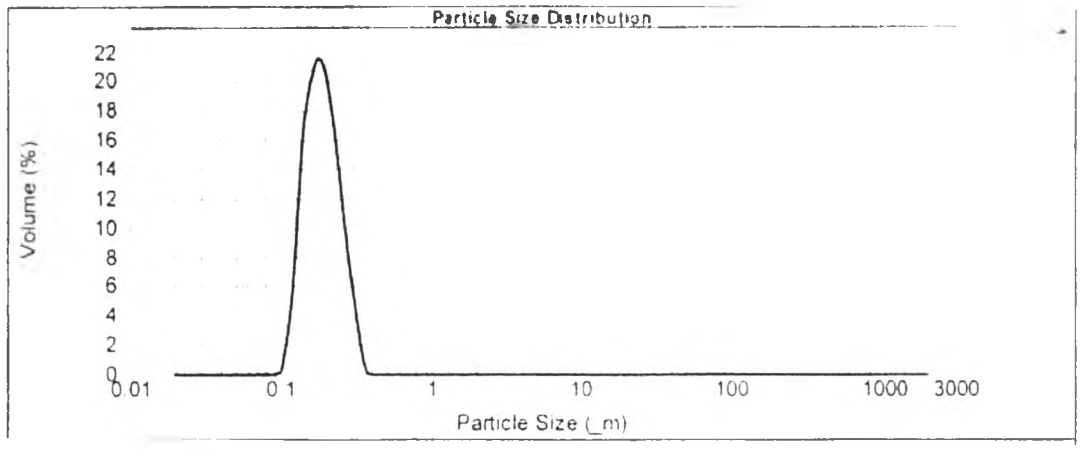

Figure d58. Particle size distribution of 10% bo+SPC+T80+SA autoclaved emulsion after storage for 10 weeks

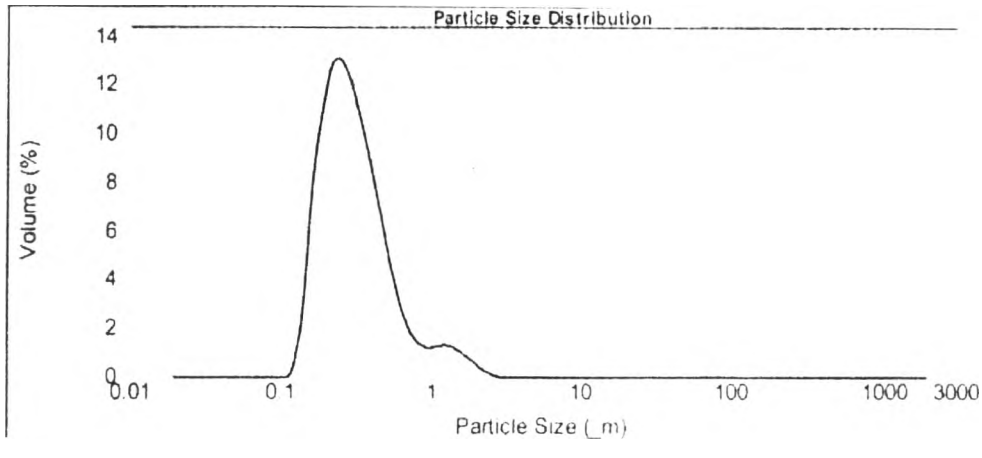

Figure d59. Particle size distribution of 10% so+EPC unautoclaved emulsion

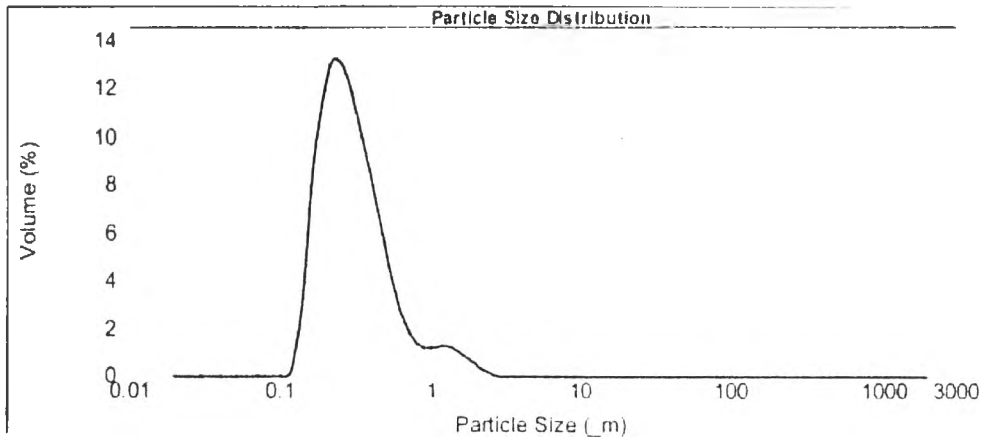

Figure d60. Particle size distribution of 10% so+EPC unautoclaved emulsion after storage for 3 weeks

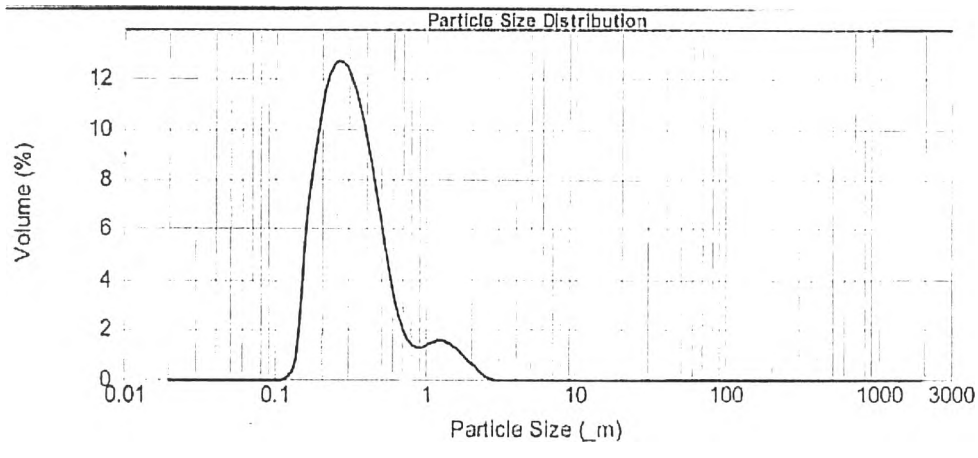

Figure d61. Particle size distribution of 10% so+EPC unautoclaved emulsion after storage for 4 weeks

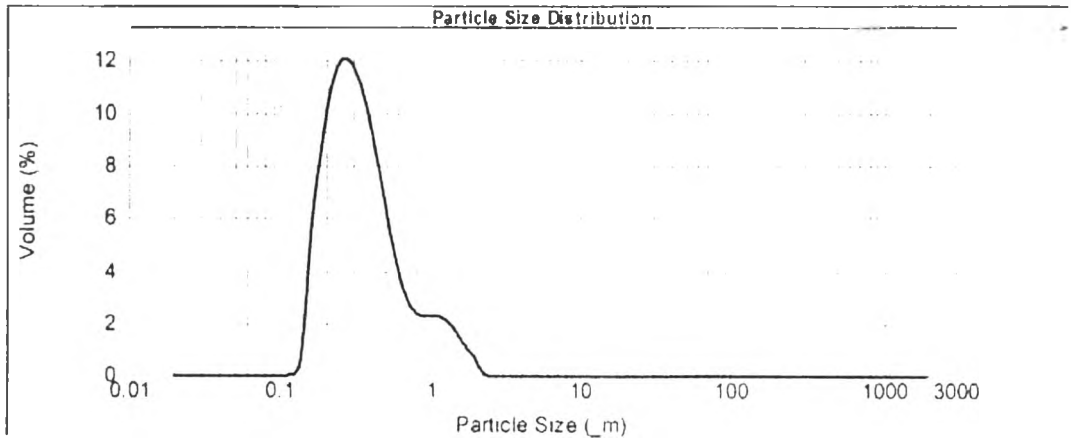

Figure d62. Particle size distribution of 10% so+EPC unautoclaved emulsion after storage for 14 weeks

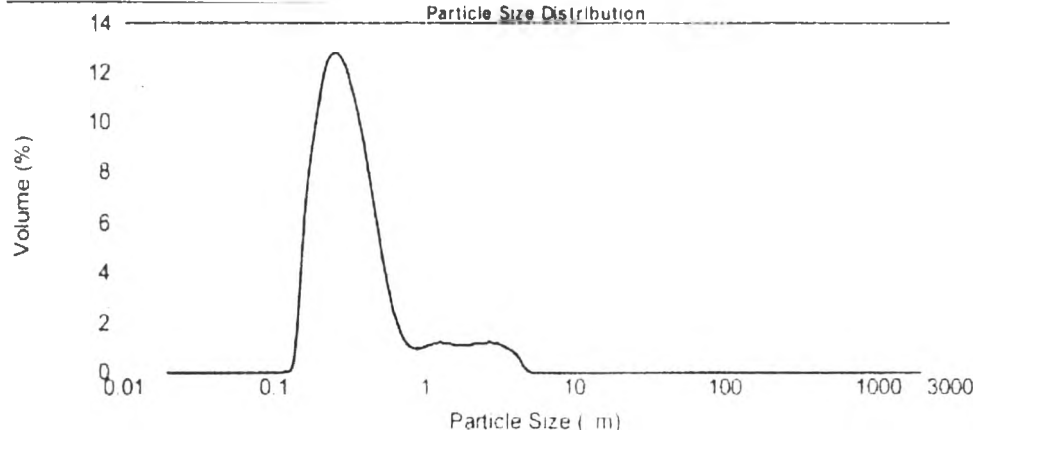

Figure d63. Particle size distribution of 10% so+EPC autoclaved emulsion

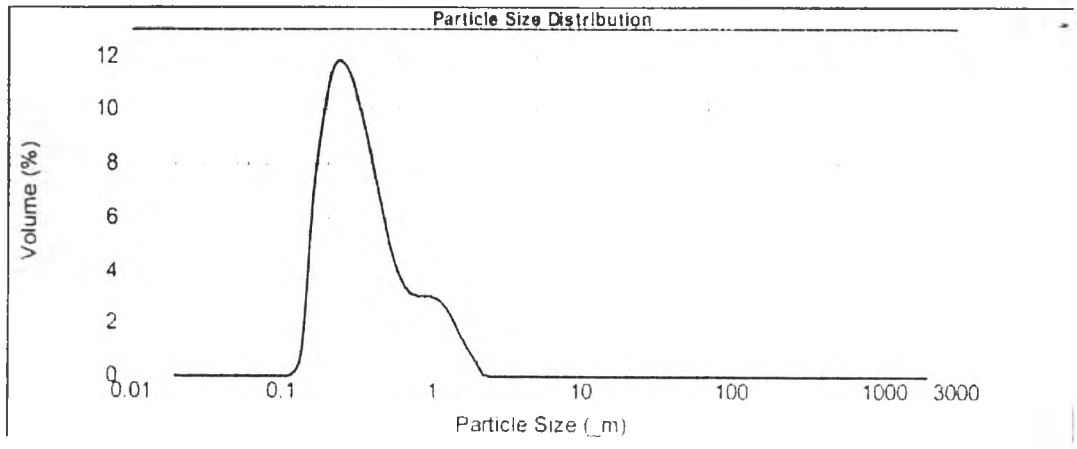

Figure d64. Particle size distribution of 10% so+EPC autoclaved emulsion after storage for 3 weeks

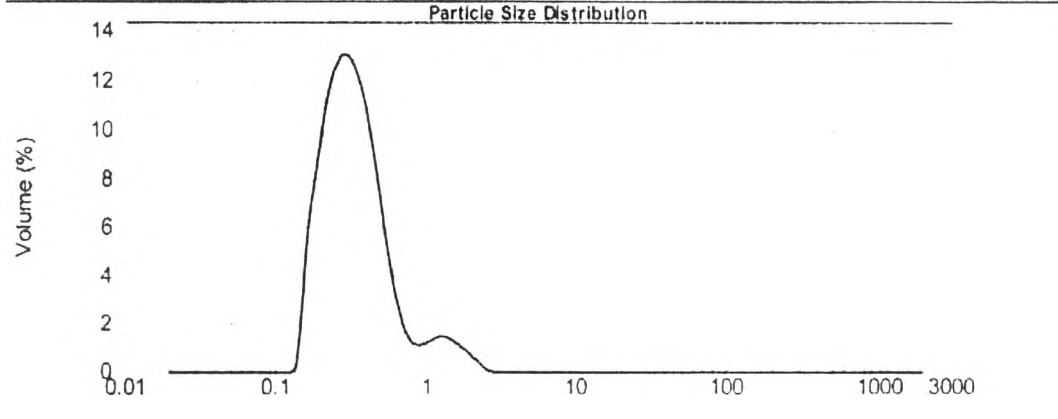

Figure d65. Particle size distribution of 10% so+EPC autoclaved emulsion after storage for 4 weeks

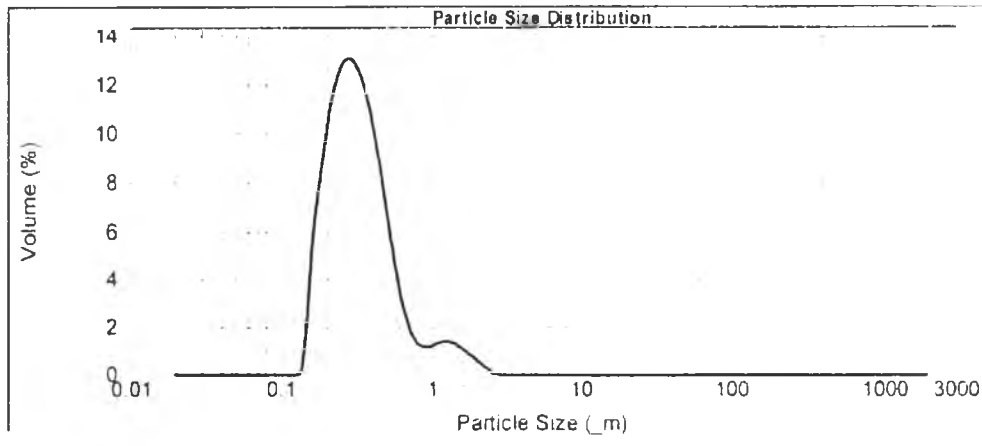

Figure d66. Particle size distribution of 10% so+EPC autoclaved emulsion after storage for 14 weeks

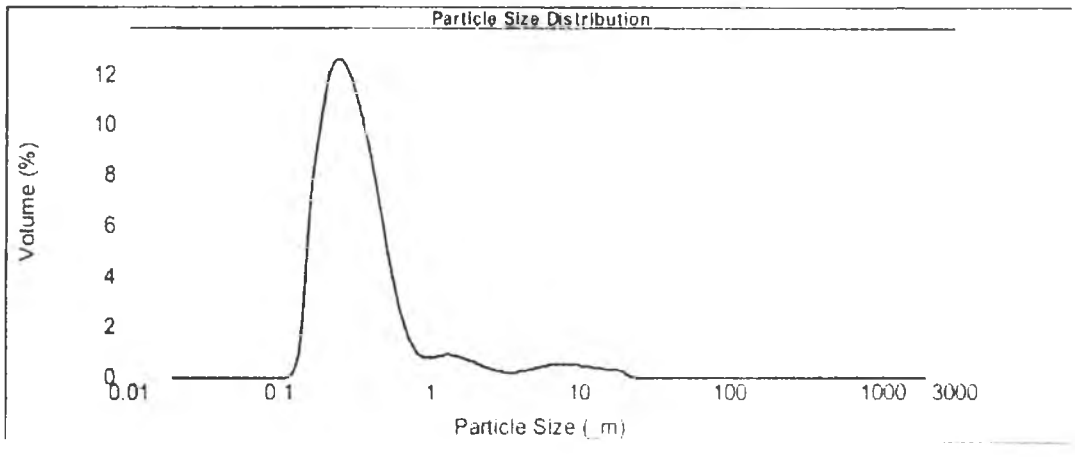

Figure d67. Particle size distribution of 10% so+EPC+SA unautoclaved emulsion

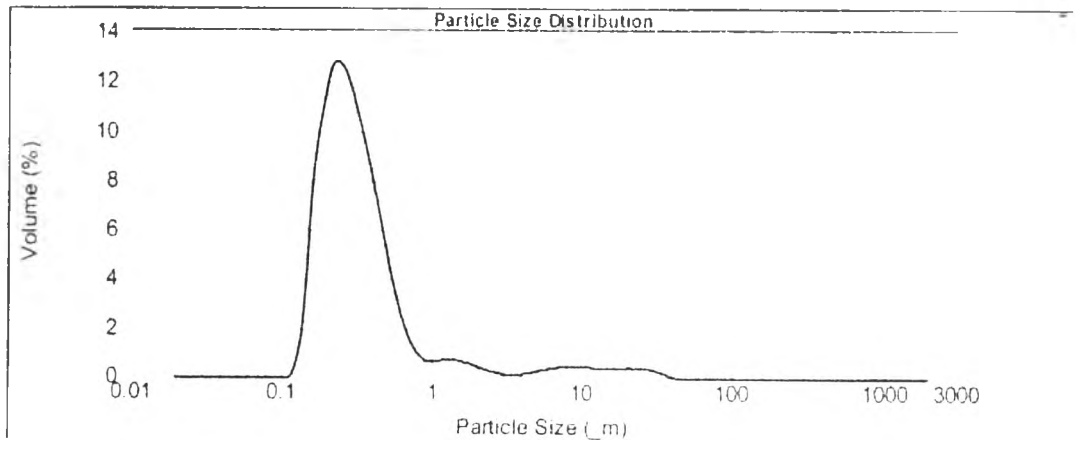

Figure d68. Particle size distribution of 10% so+EPC+SA unautoclaved emulsion after storage for 3 weeks

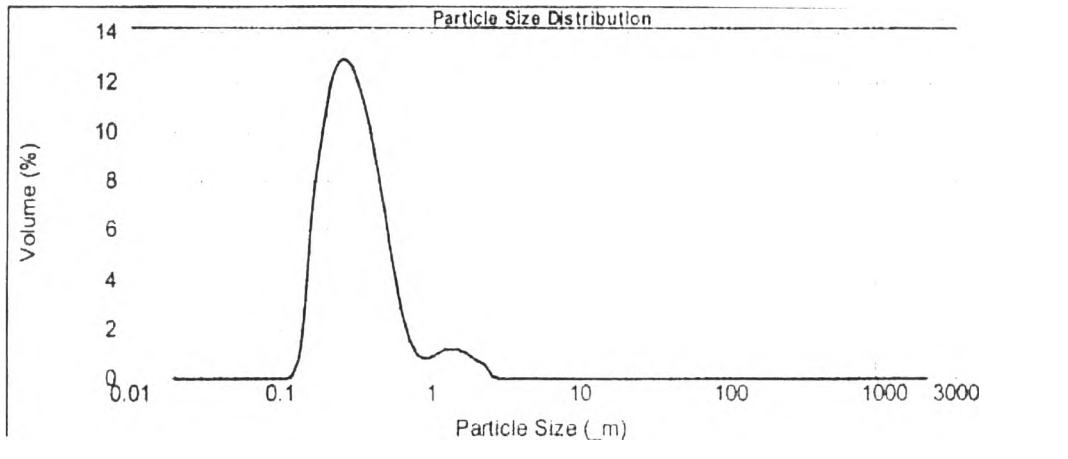

Figure d69. Particle size distribution of 10% so+EPC+SA unautoclaved emulsion after storage for 4 weeks

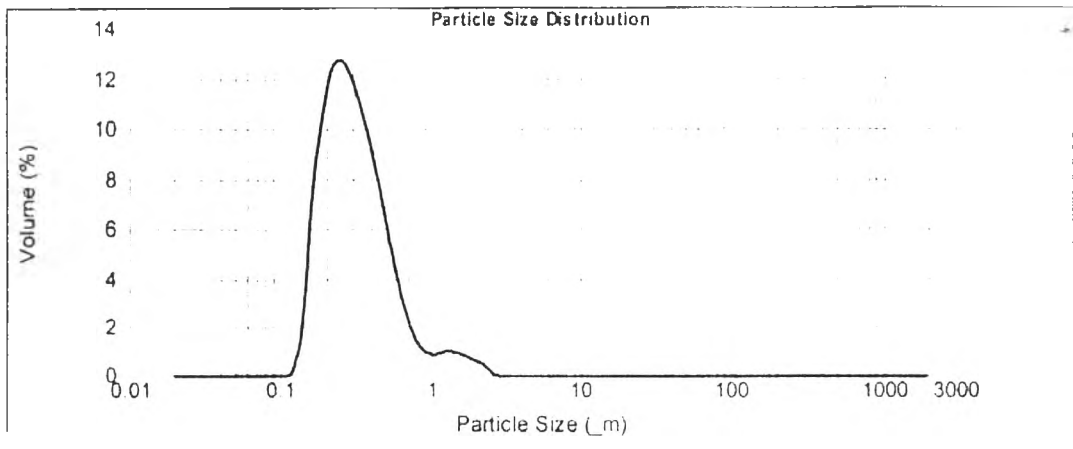

Figure d70. Particle size distribution of 10% so+EPC+SA unautoclaved emulsion after storage for 14 weeks

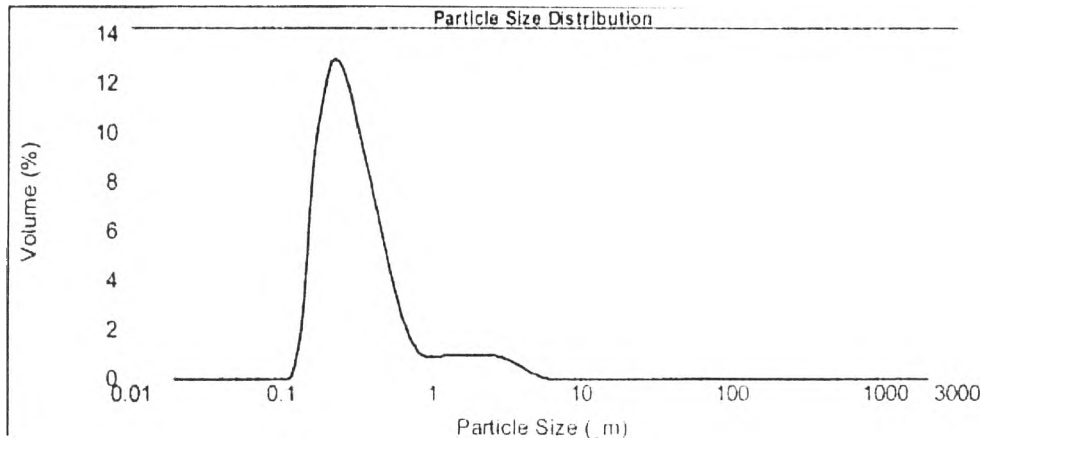

Figure d71. Particle size distribution of 10% so+EPC+SA autoclaved emulsion

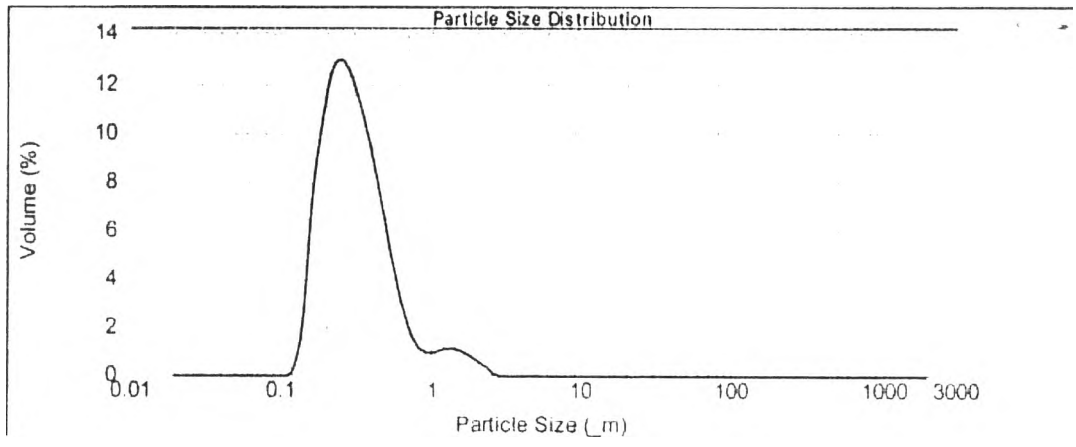

Figure d72. Particle size distribution of 10% so+EPC+SA autoclaved emulsion after storage for 3 weeks

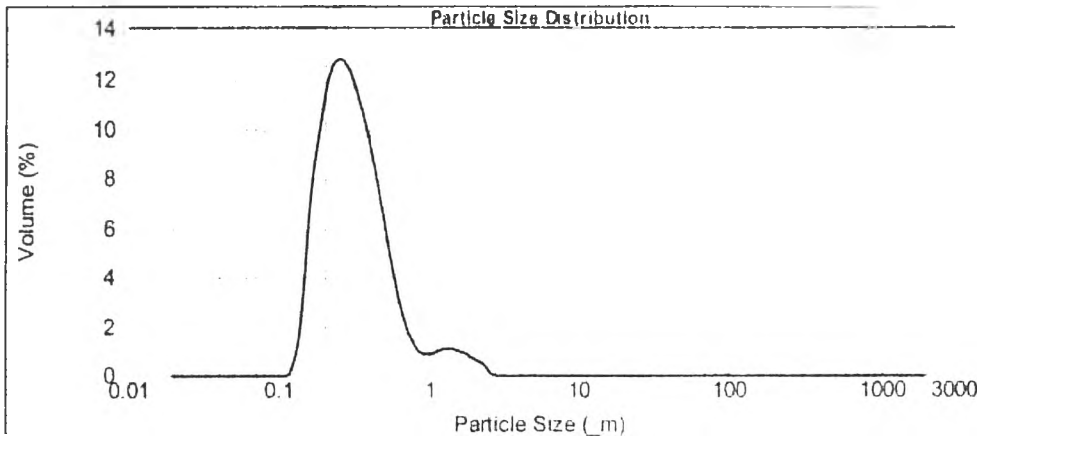

Figure d73. Particle size distribution of 10% so+EPC+SA autoclaved emulsion after storage for 4 weeks

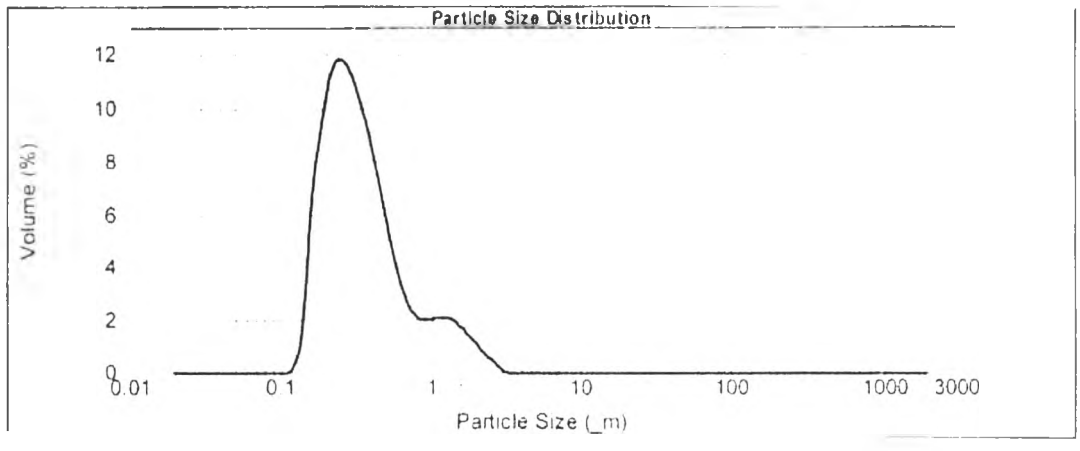

Figure d74. Particle size distribution of 10% so+EPC+SA autoclaved emulsion after storage for 14 weeks

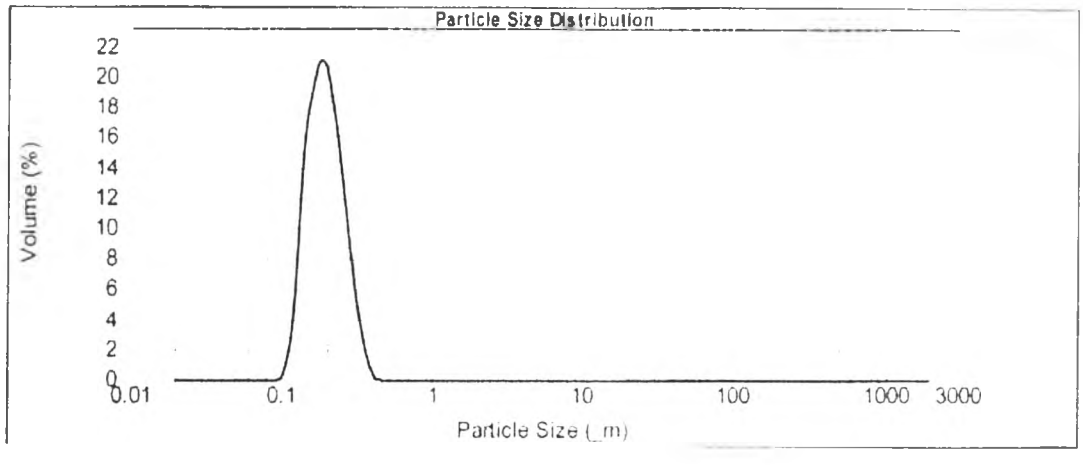

Figure d75. Particle size distribution of 10% so+EPC+T80 unautoclaved emulsion

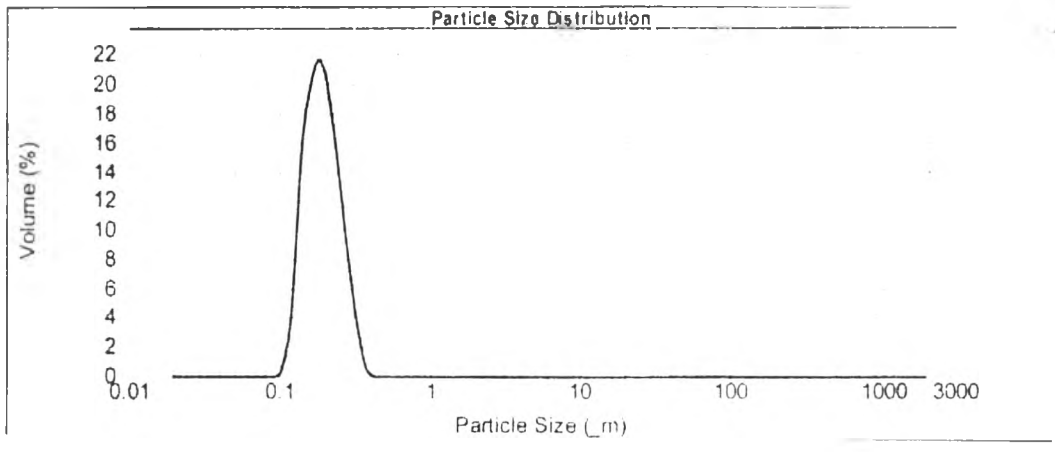

Figure d76. Particle size distribution of 10% so+EPC+T80 unautoclaved emulsion after storage for 1 week

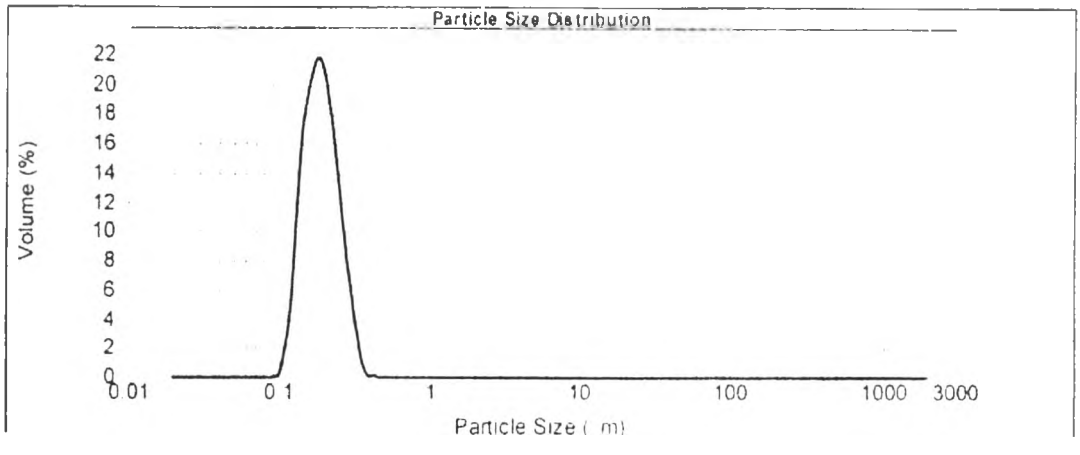

Figure d77. Particle size distribution of 10% so+EPC+T80 unautoclaved emulsion after storage for 4 weeks

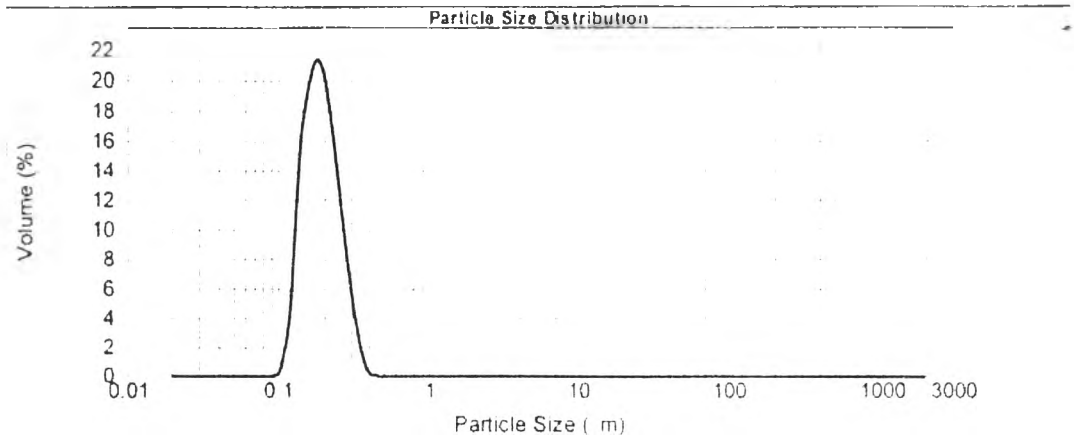

Figure d78. Particle size distribution of 10% so+EPC+T80 unautoclaved emulsion after storage for 12 weeks

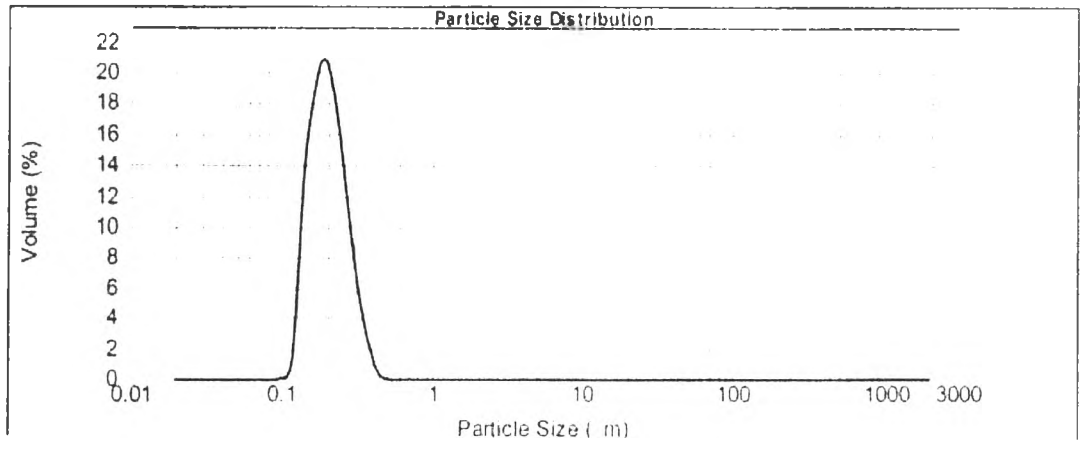

Figure d79. Particle size distribution of 10% so+EPC+T80 autoclaved emulsion

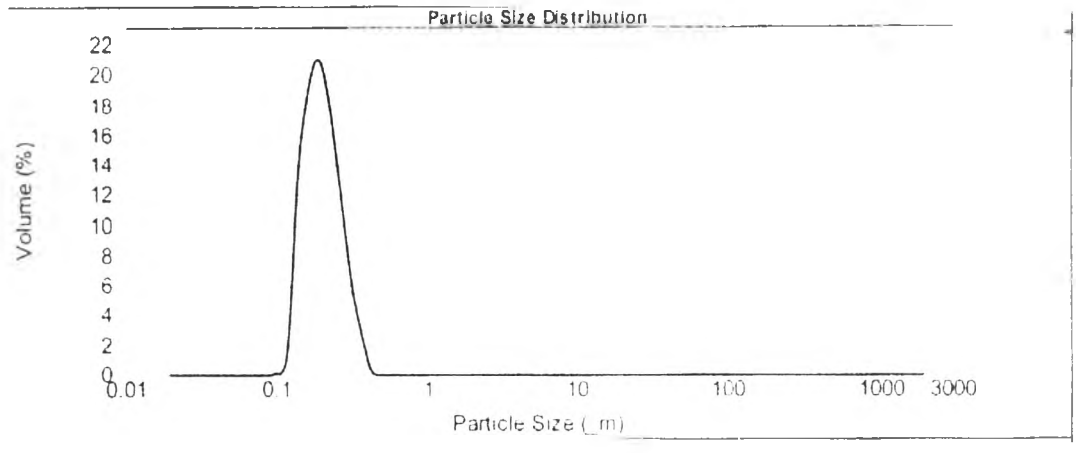

Figure d80. Particle size distribution of 10% so+EPC+T80 autoclaved emulsion after storage for 1 week

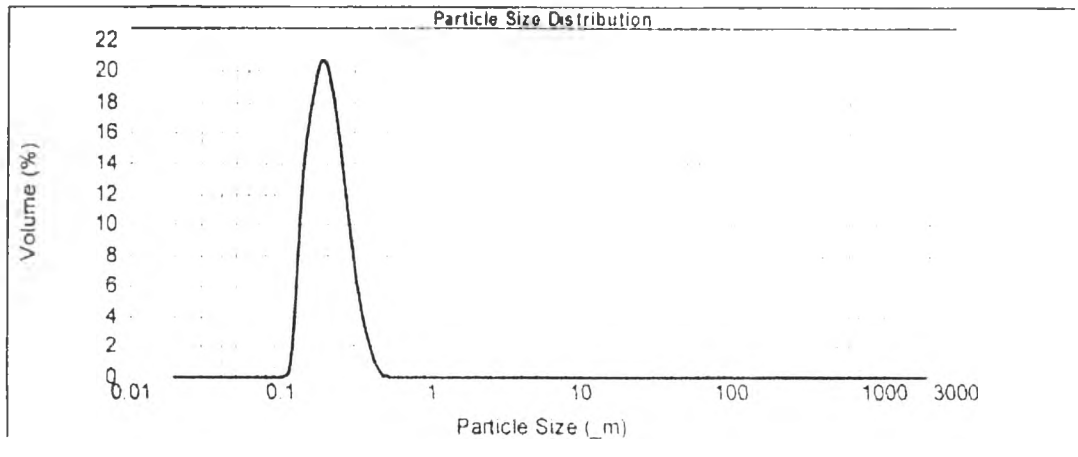

Figure d81. Particle size distribution of 10% so+EPC+T80 autoclaved emulsion after storage for 4 weeks

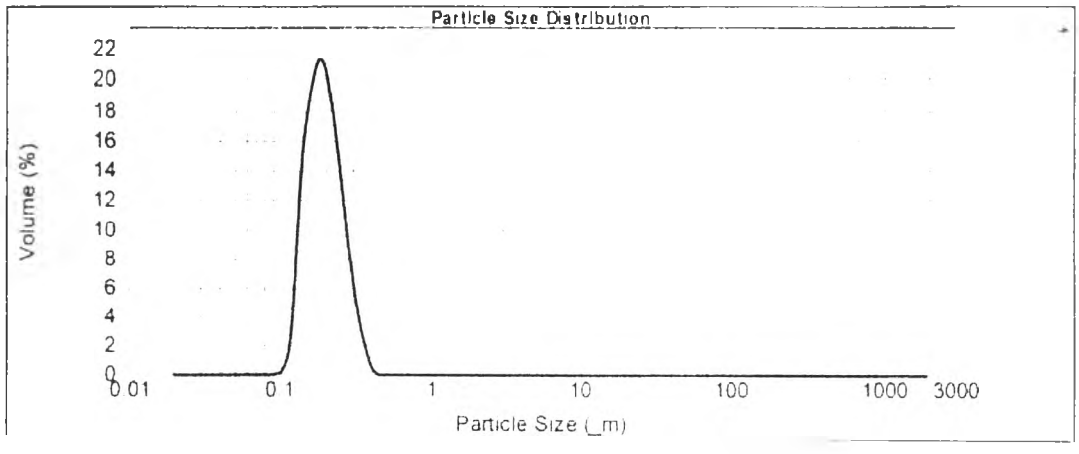

Figure d82. Particle size distribution of 10% so+EPC+T80 autoclaved emulsion after storage for 12 weeks

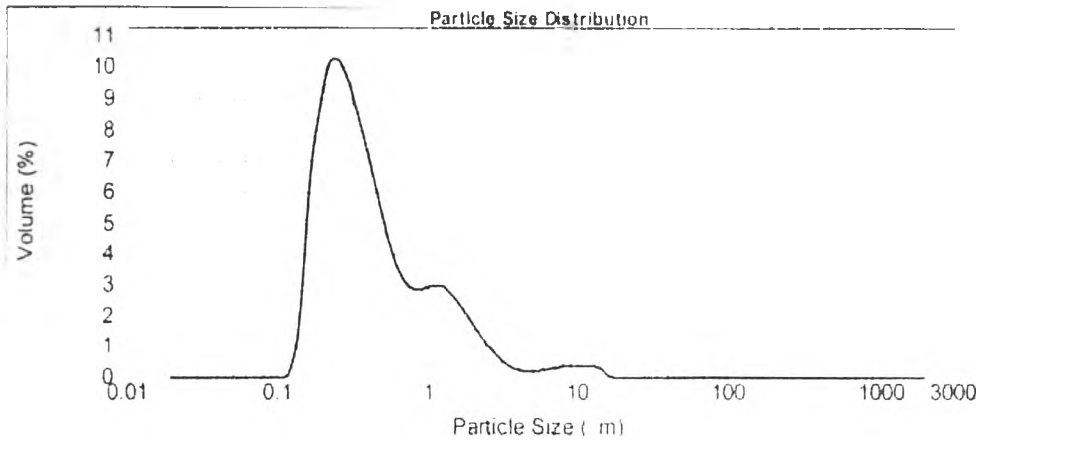

Figure d83. Particle size distribution of 10% so+EPC+PG unautoclaved emulsion

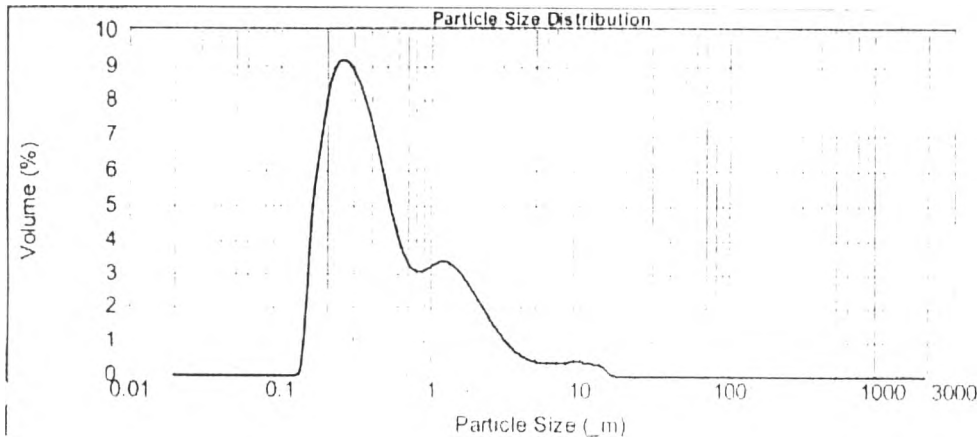

Figure d84. Particle size distribution of 10% so+EPC+PG unautoclaved emulsion after storage for 1 week

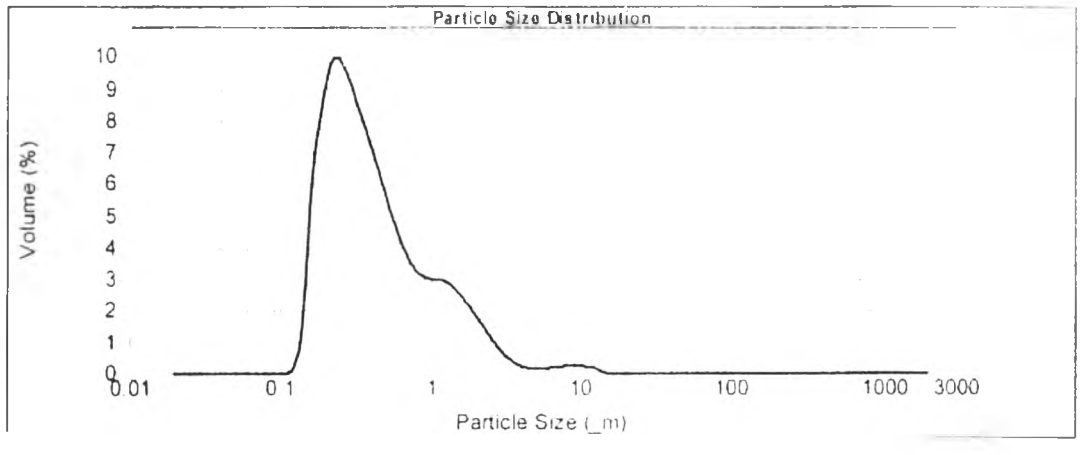

Figure d85. Particle size distribution of 10% so+EPC+PG unautoclaved emulsion after storage for 4 weeks

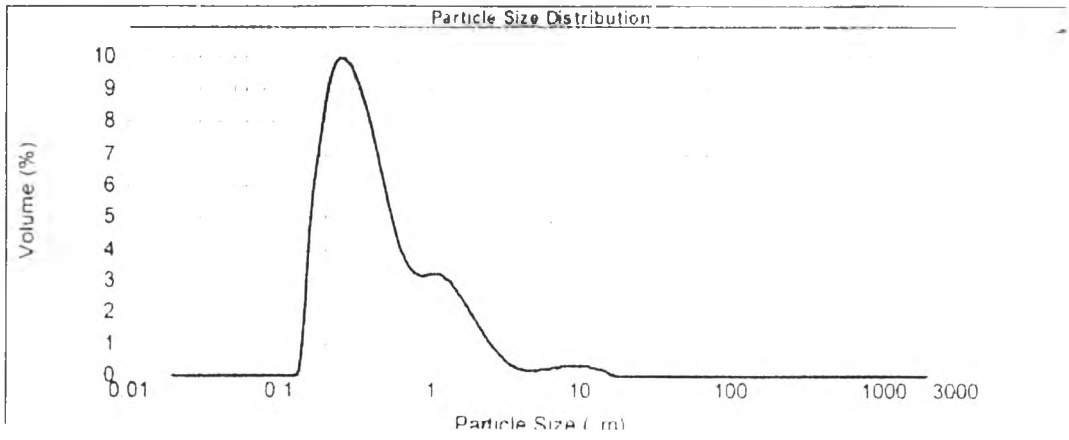

Figure d86. Particle size distribution of 10% so+EPC+PG unautoclaved emulsion after storage for 11 weeks

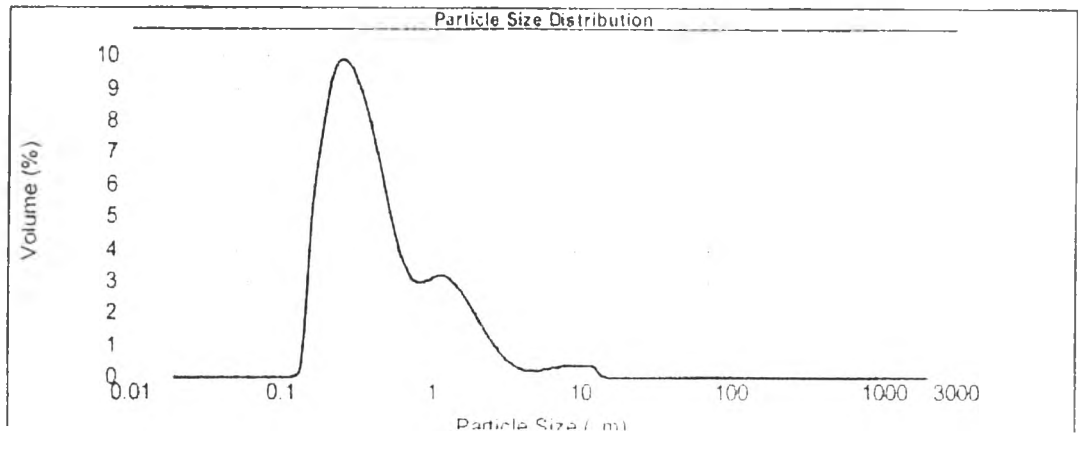

Figure d87. Particle size distribution of 10% so+EPC+PG autoclaved emulsion

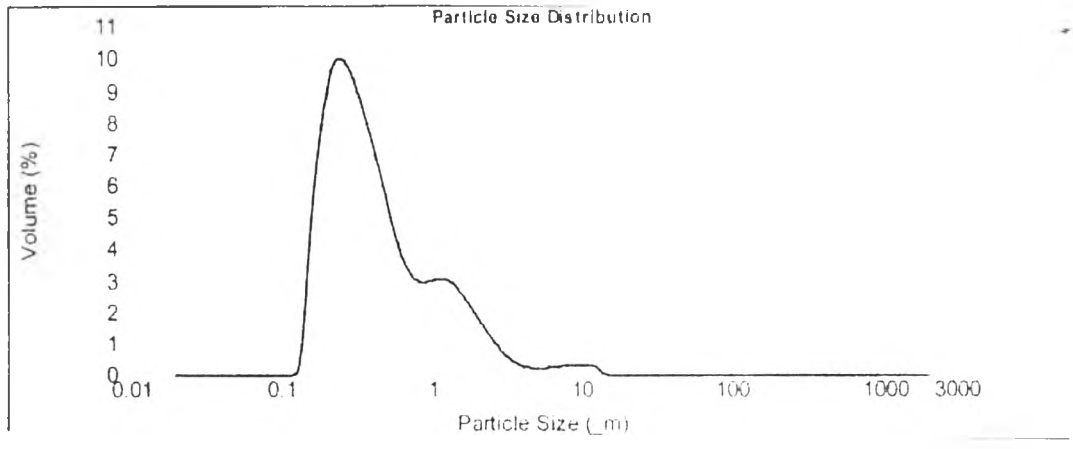

Figure d88. Particle size distribution of 10% so+EPC+PG autoclaved emulsion after storage for 1 week

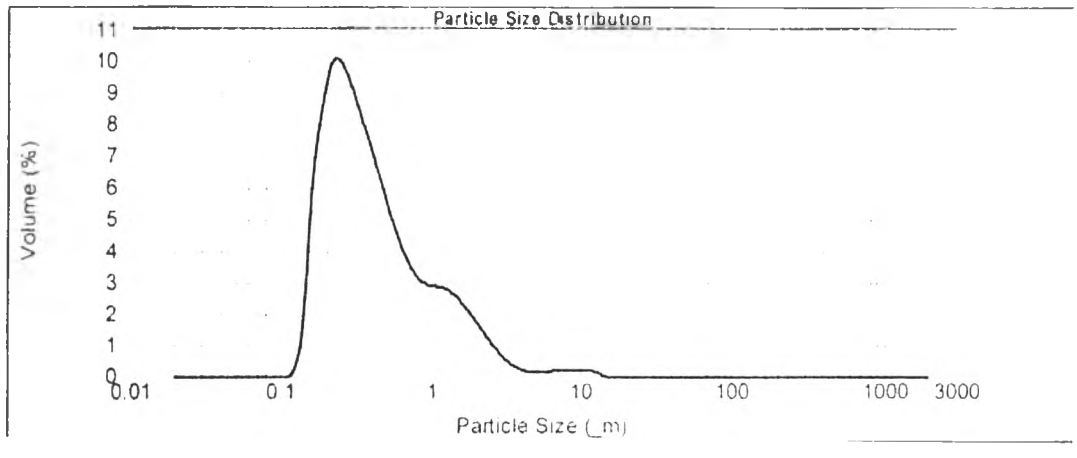

Figure d89. Particle size distribution of 10% so+EPC+PG autoclaved emulsion after storage for 4 weeks

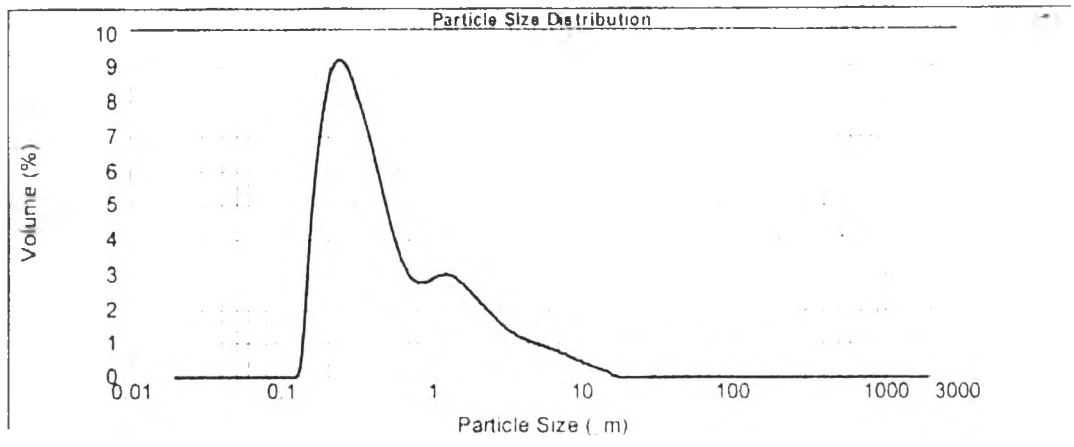

Figure d90. Particle size distribution of 10% so+EPC+PG autoclaved emulsion after storage for 11 weeks

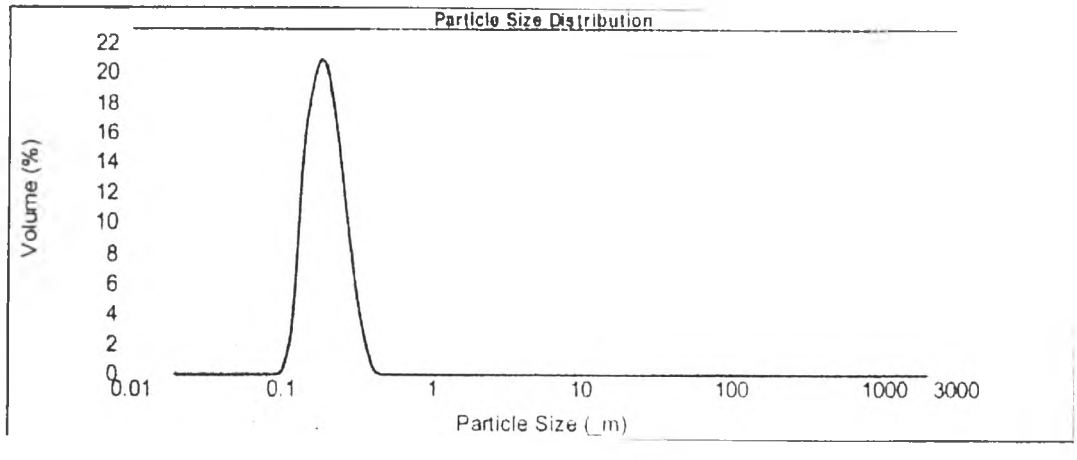

Figure d91. Particle size distribution of 10% so+EPC+T80+SA unautoclaved emulsion

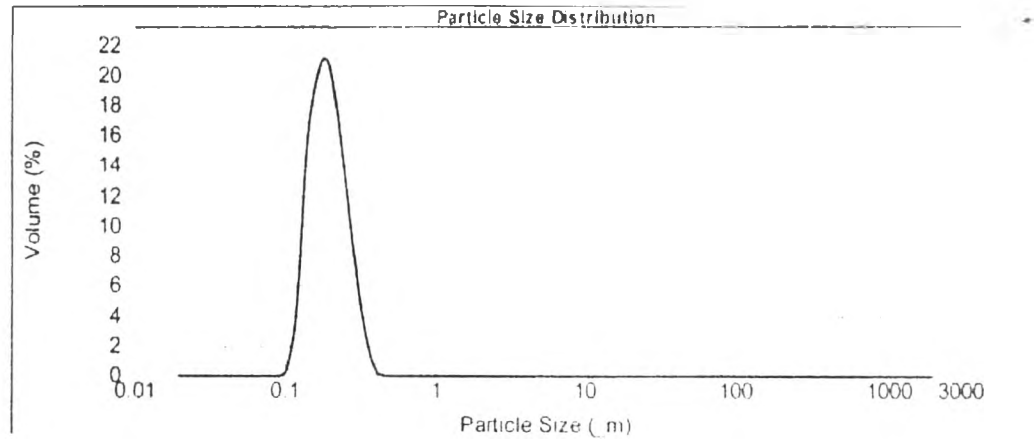

Figure d92. Particle size distribution of 10% so+EPC+T80+SA unautoclaved emulsion after storage for 1 week

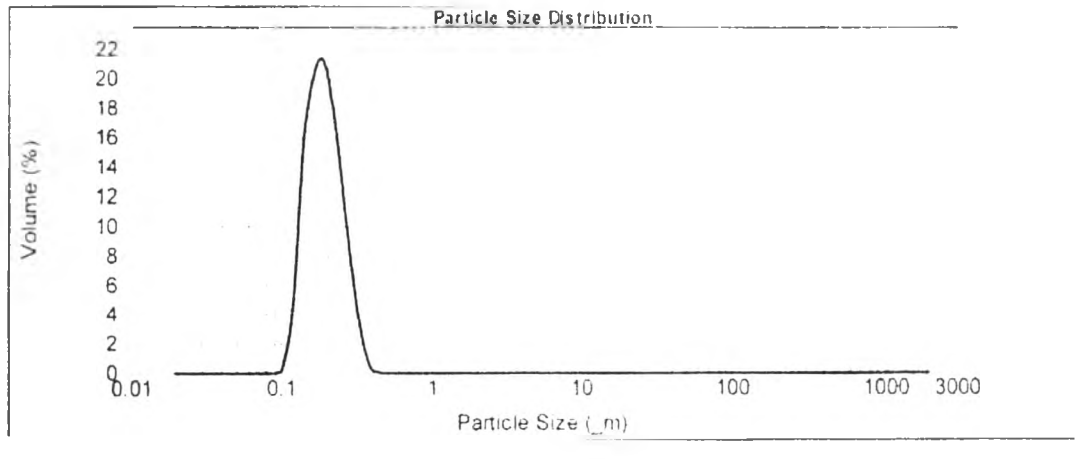

Figure d93. Particle size distribution of 10% so+EPC+T80+SA unautoclaved emulsion after storage for 4 weeks

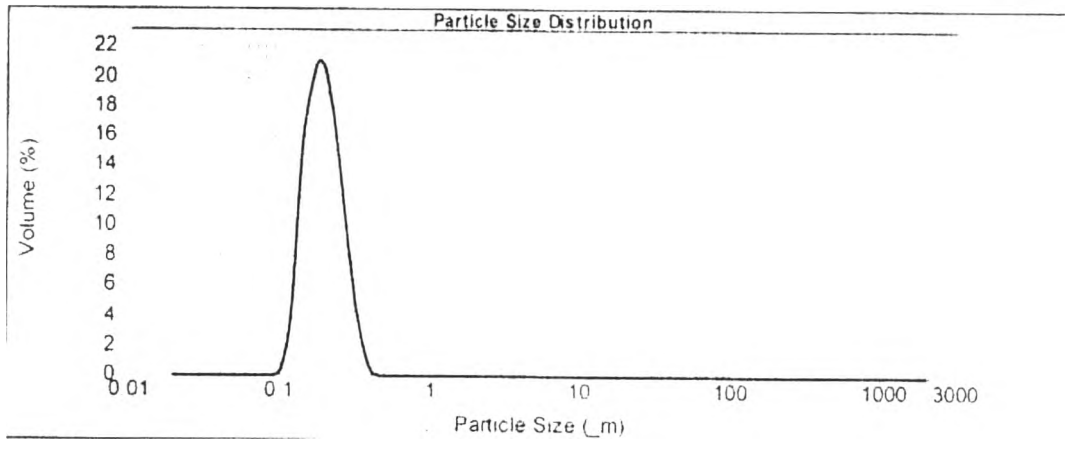

Figure d94. Particle size distribution of 10% so+EPC+T80+SA unautoclaved emulsion after storage for 10 weeks

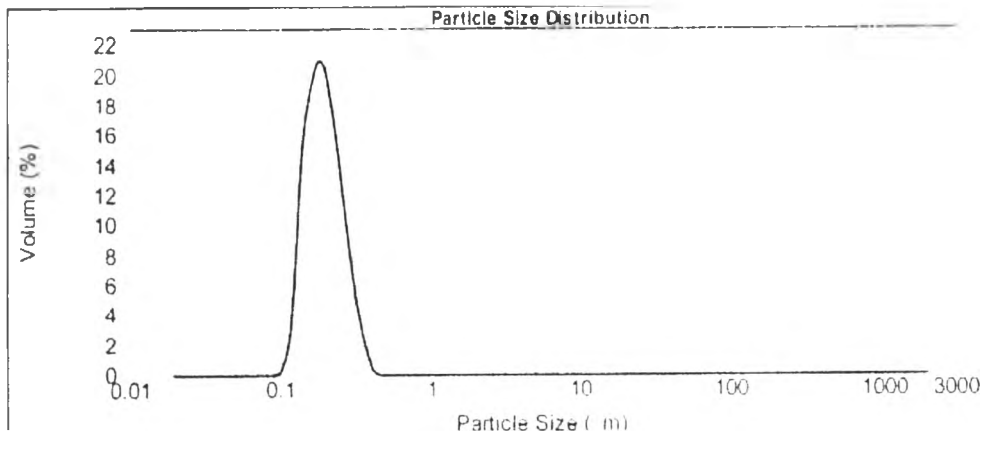

Figure d95. Particle size distribution of 10% so+EPC+T80+SA autoclaved emulsion

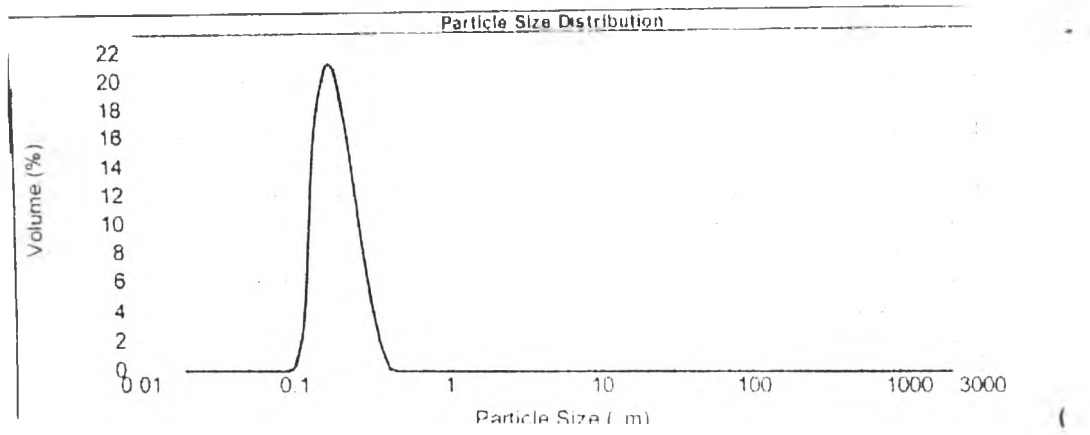

Figure d96. Particle size distribution of 10% so+EPC+T80+SA autoclaved emulsion after storage for 1 week

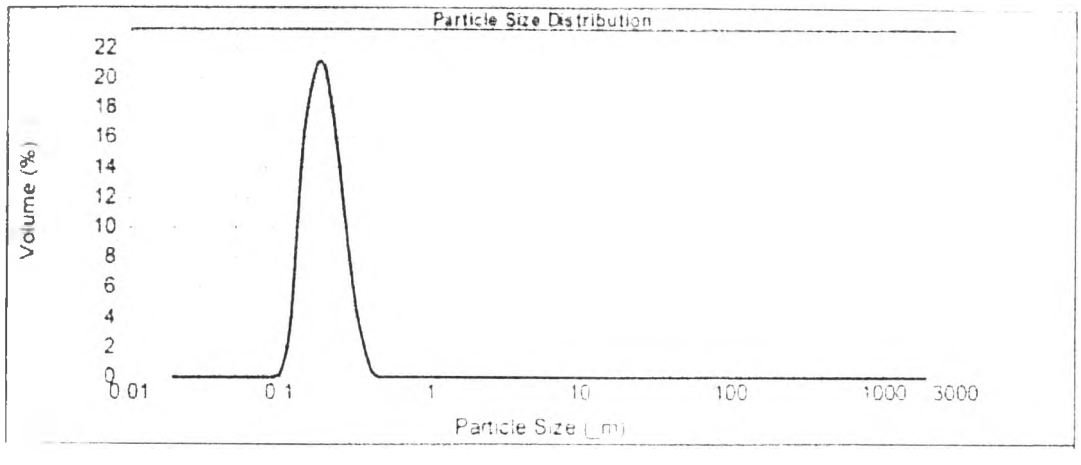

Figure d97. Particle size distribution of 10% so+EPC+T80+SA autoclaved emulsion after storage for 4 weeks

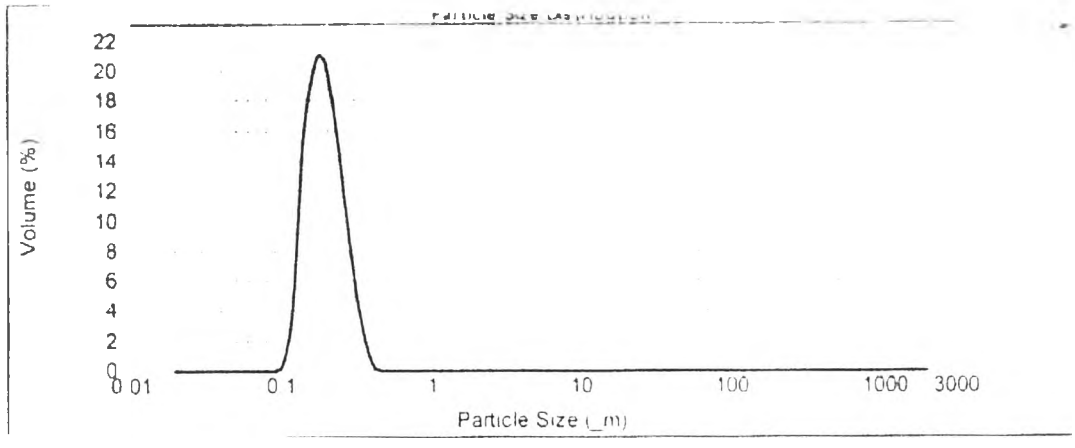

Figure d98. Particle size distribution of 10% so+EPC+T80+SA autoclaved emulsion after storage for 10 weeks

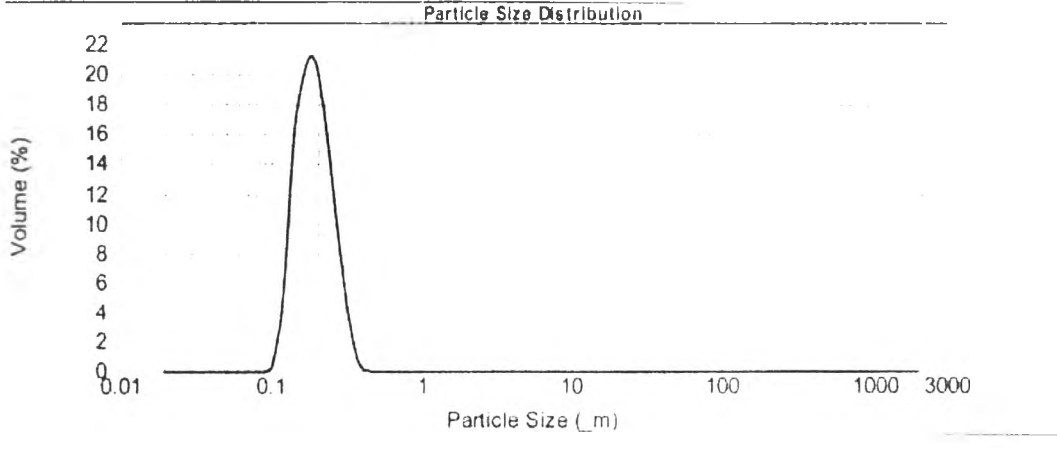

Figure d99. Particle size distribution of 10% so+SPC+T80+SA unautoclaved emulsion

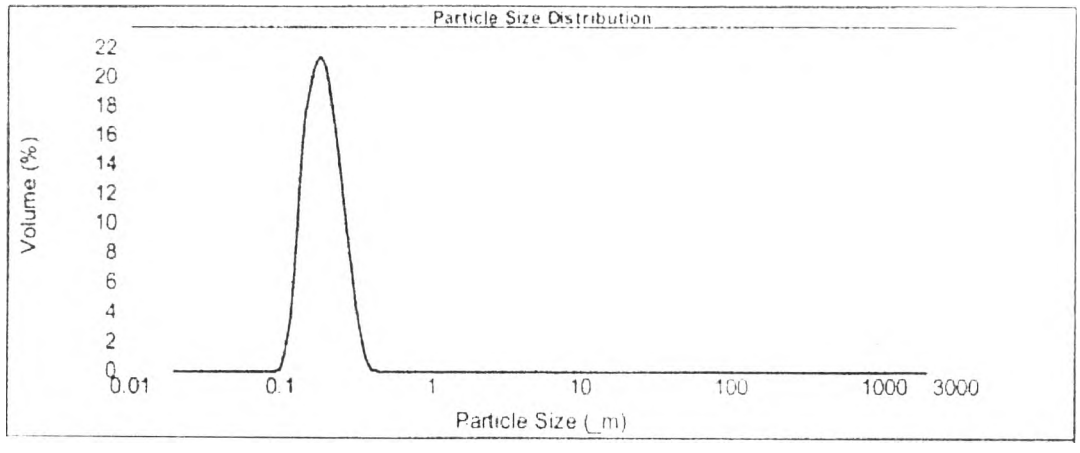

Figure d100. Particle size distribution of 10% so+SPC+T80+SA unautoclaved emulsion after storage for 1 week

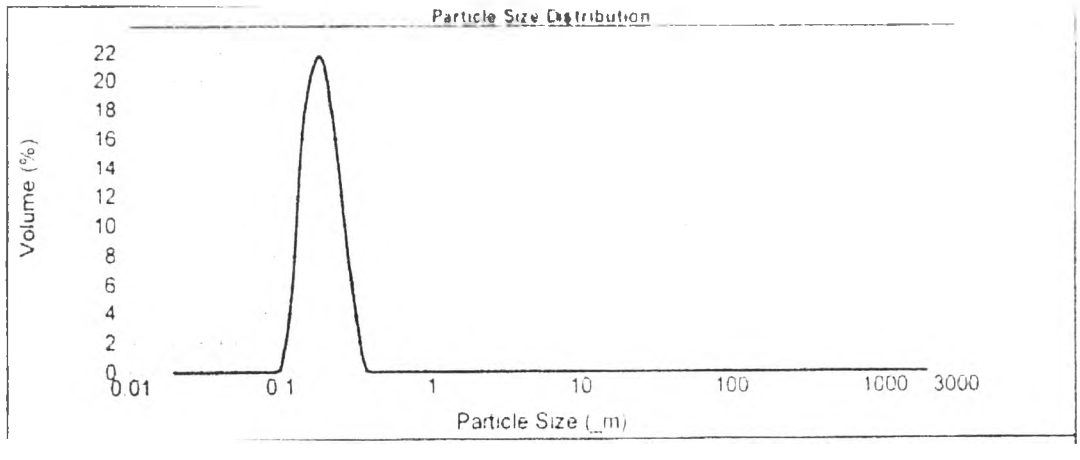

Figure d101. Particle size distribution of 10% so+SPC+T80+SA unautoclaved emulsion after storage for 4 weeks

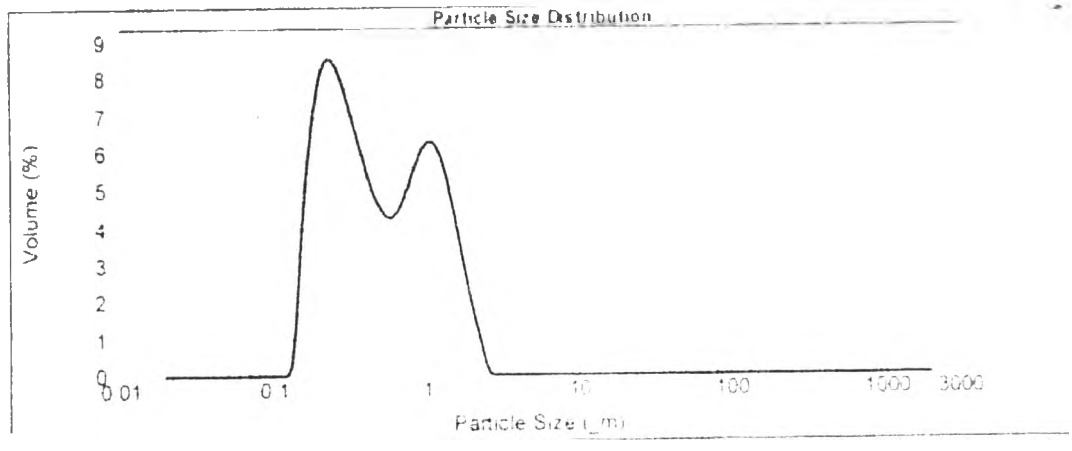

Figure d102. Particle size distribution of 10% so+SPC−T80+SA unautoclaved emulsion after storage for 10 weeks

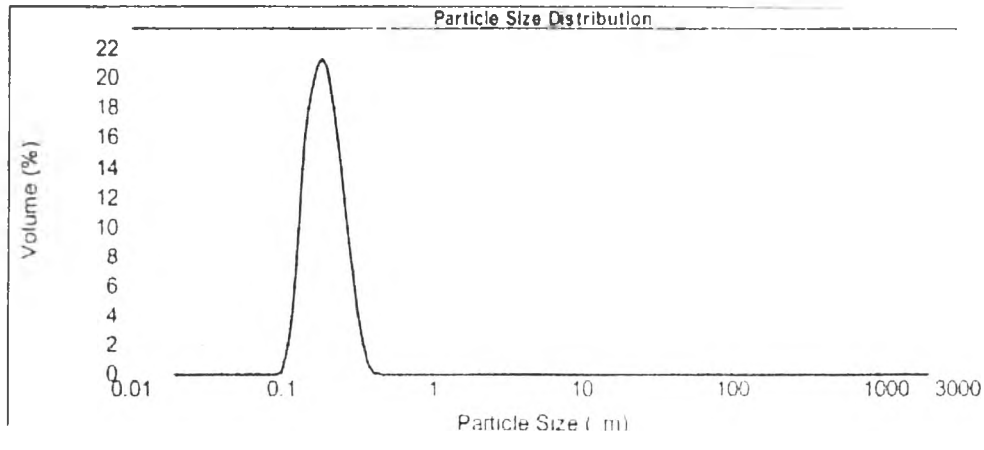

Figure d103. Particle size distribution of 10% so+SPC+T80+SA autoclaved emulsion

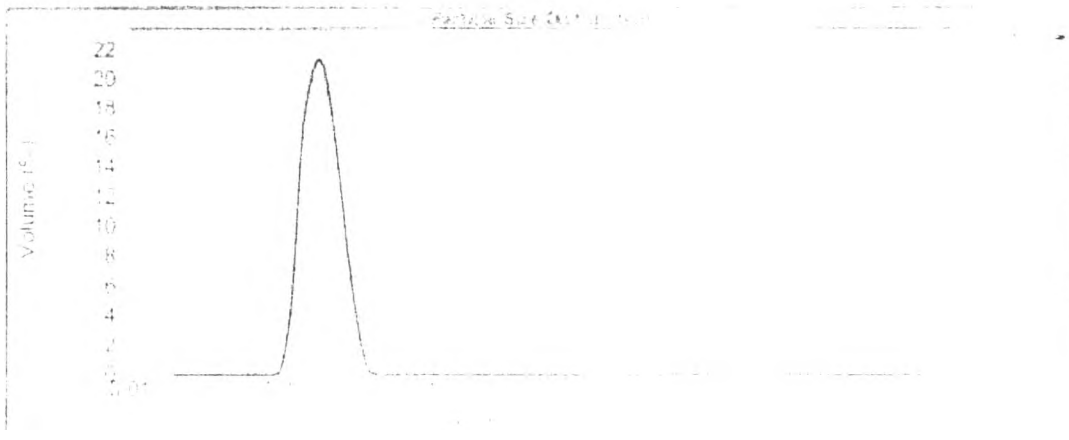

Figure d104. Particle size distribution of 10% so+SPC+T80+SA autoclaved emulsion after storage for 1 week

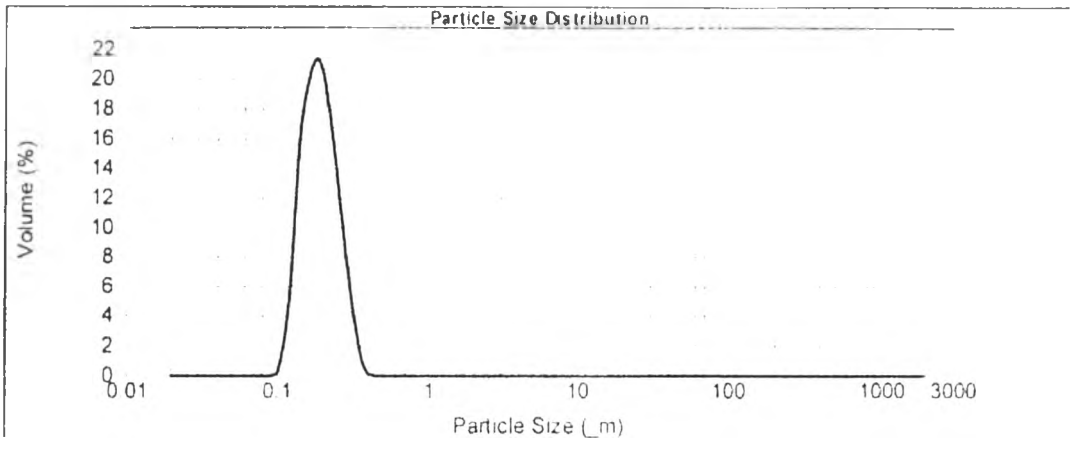

Figure d105. Particle size distribution of 10% so+SPC+T80+SA autoclaved emulsion after storage for 4 weeks

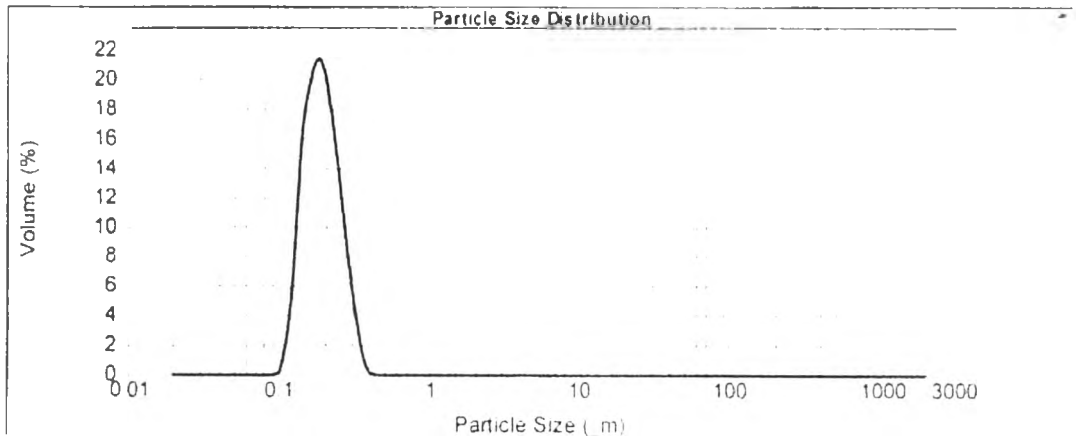

Figure d106. Particle size distribution of 10% so+SPC+T80+SA autoclaved emulsion after storage for 10 weeks

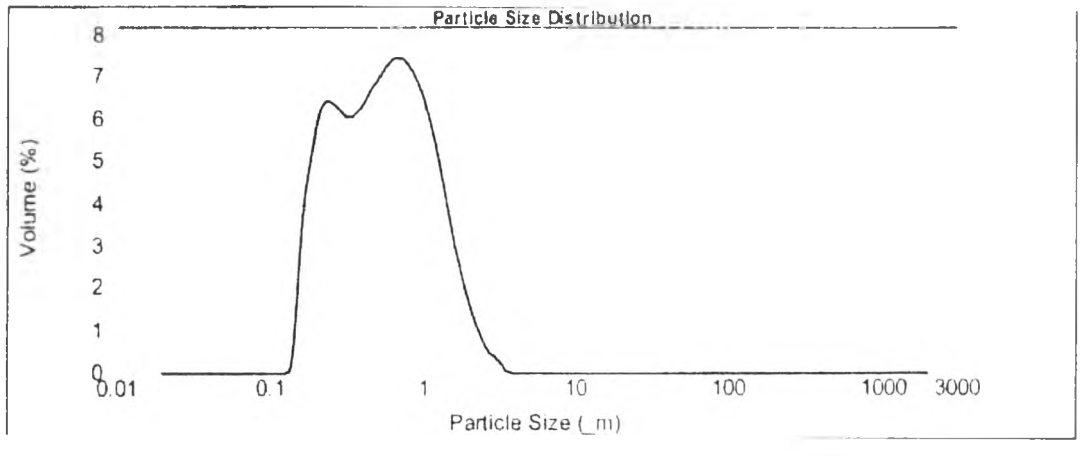

Figure d107. Particle size distribution of 20% bo+EPC unautoclaved emulsion

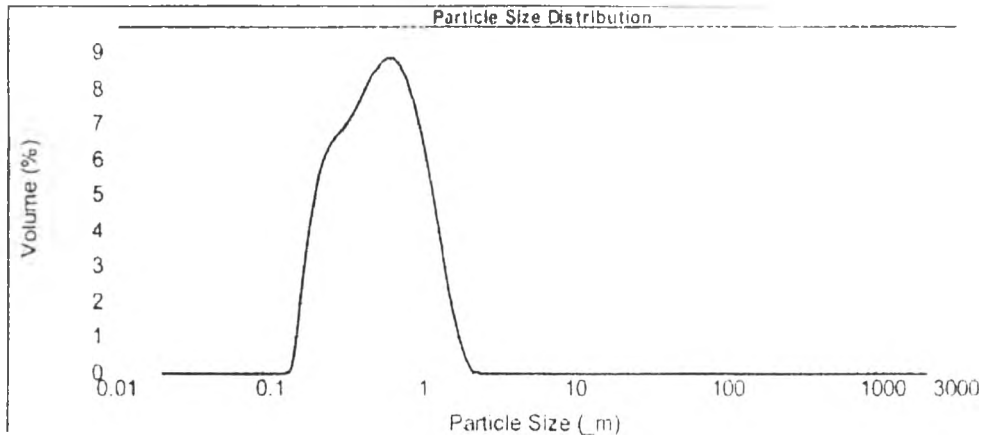

Figure d108. Particle size distribution of 20% bo+EPC unautoclaved emulsion after storage for 3 weeks

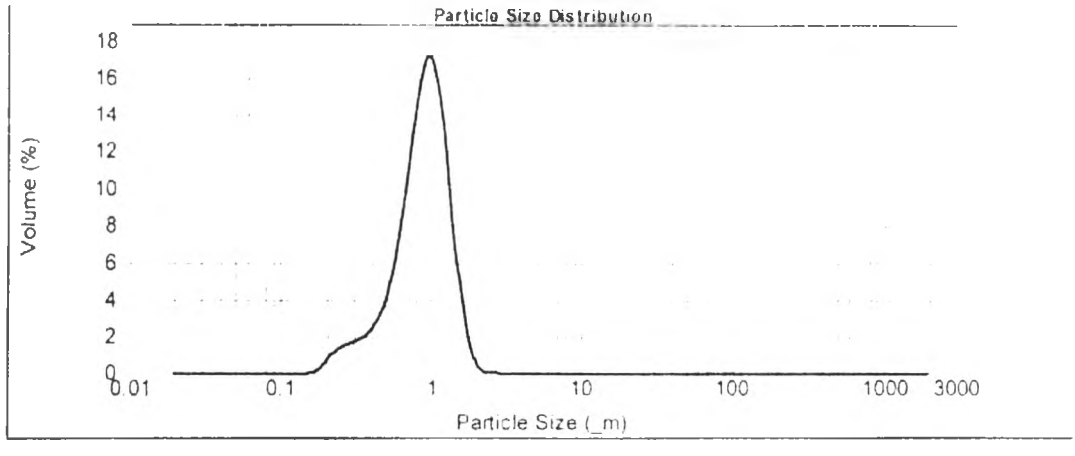

Figure d109. Particle size distribution of 20% bo+EPC unautoclaved emulsion after storage for 4 weeks

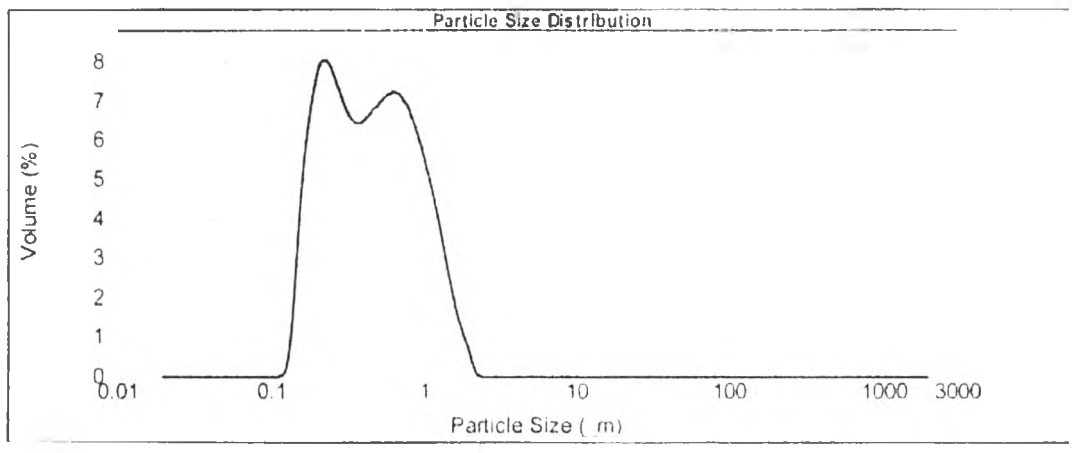

Figure d110. Particle size distribution of 20% bo+EPC unautoclaved emulsion after storage for 14 weeks

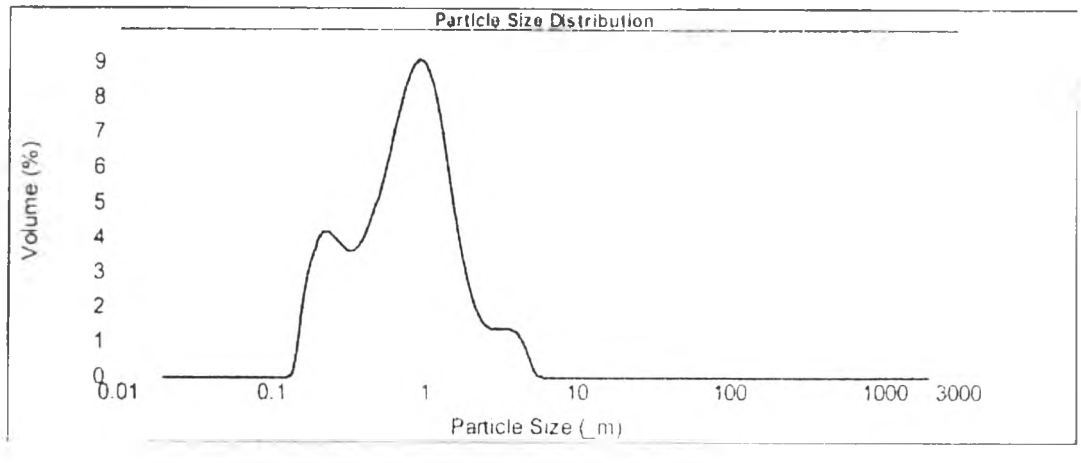

Figure d111. Particle size distribution of 20% bo+EPC autoclaved emulsion

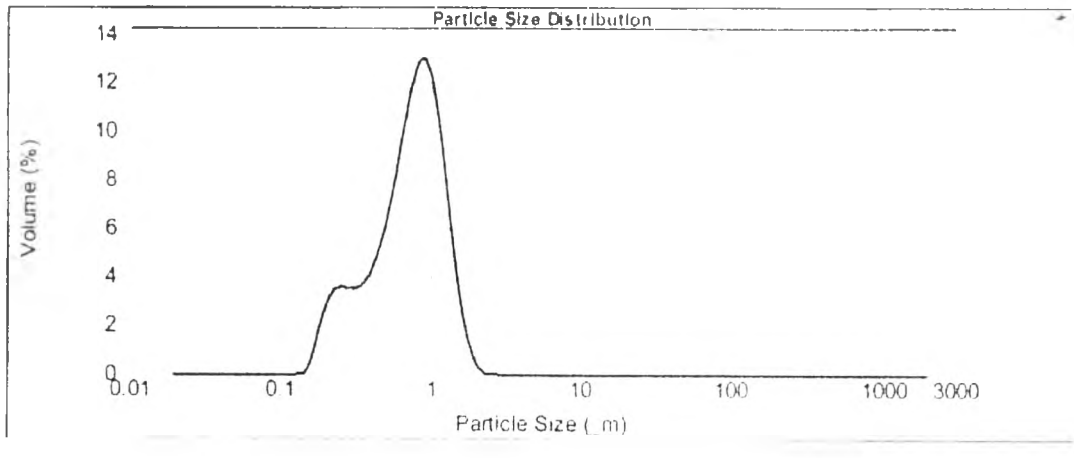

Figure d112. Particle size distribution of 20% bo+EPC autoclaved emulsion after storage for 3 weeks

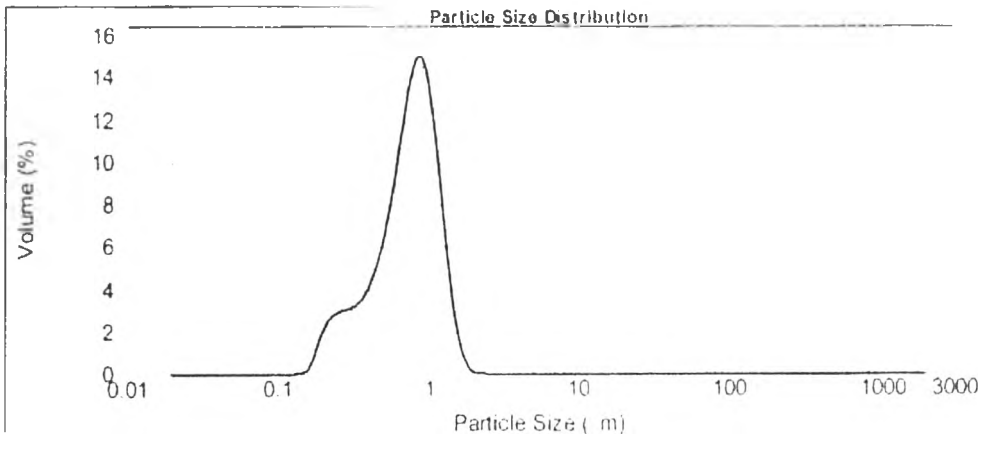

Figure d113. Particle size distribution of 20% bo+EPC autoclaved emulsion after storage for 4 weeks

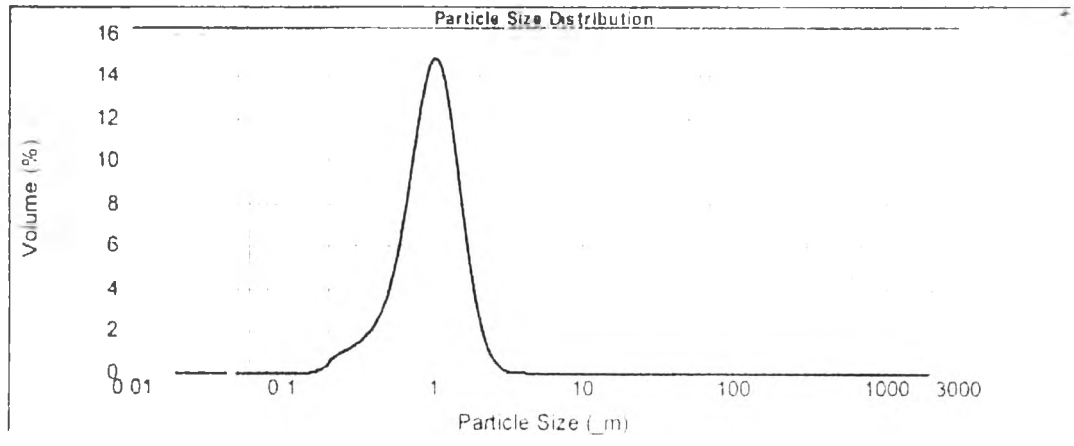

Figure d114. Particle size distribution of 20% bo+EPC autoclaved emulsion after storage for 14 weeks

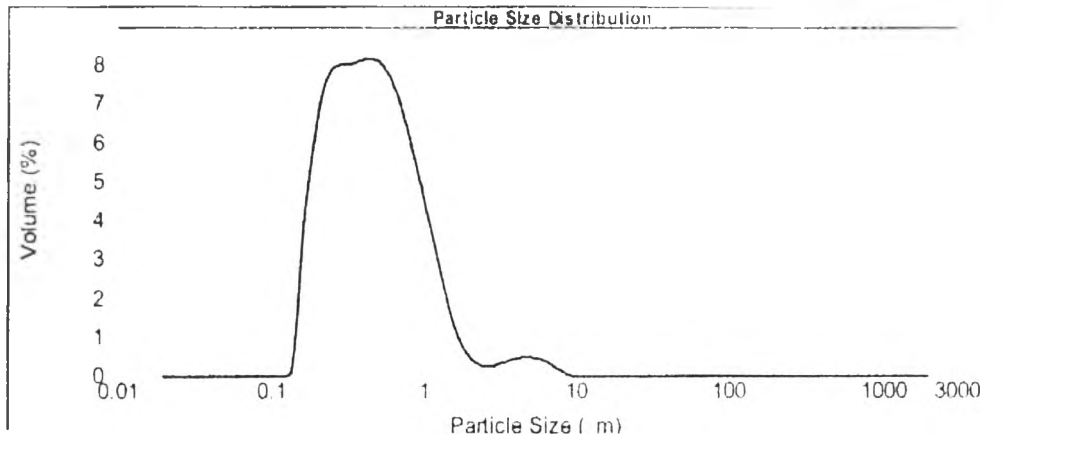

Figure d115. Particle size distribution of 20% bo+EPC+SA unautoclaved emulsion

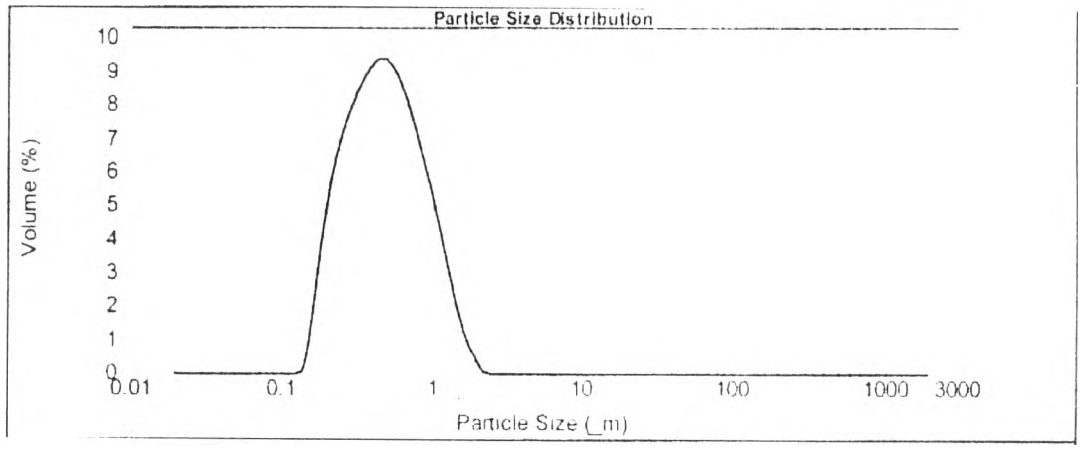

Figure d116. Particle size distribution of 20% bo+EPC+SA unautoclaved emulsion after storage for 3 weeks

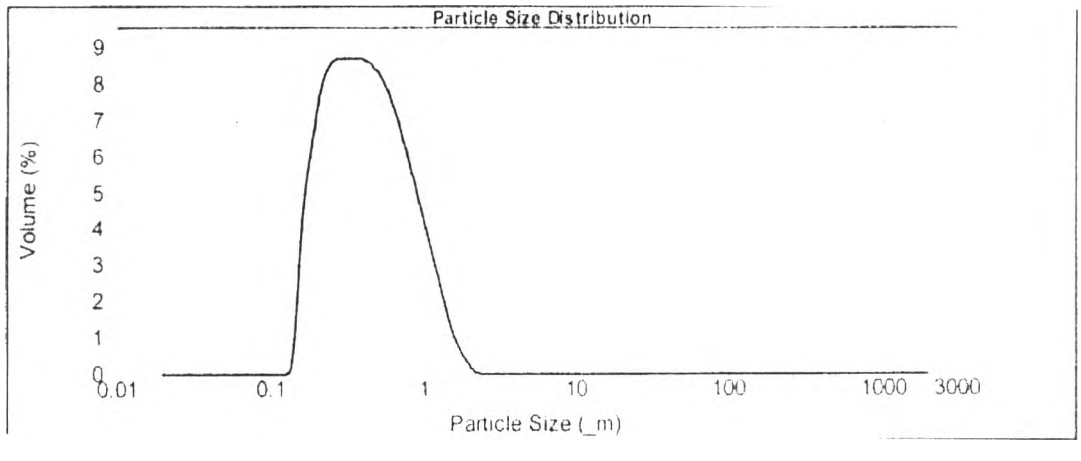

Figure d117. Particle size distribution of 20% bo+EPC+SA unautoclaved emulsion after storage for 4 weeks

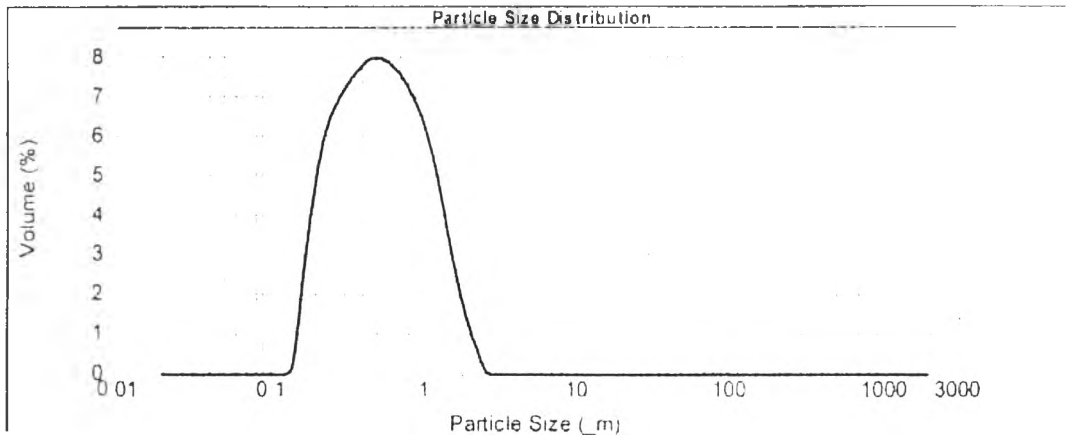

Figure d118. Particle size distribution of 20% bo+EPC+SA unautoclaved emulsion after storage for 14 weeks

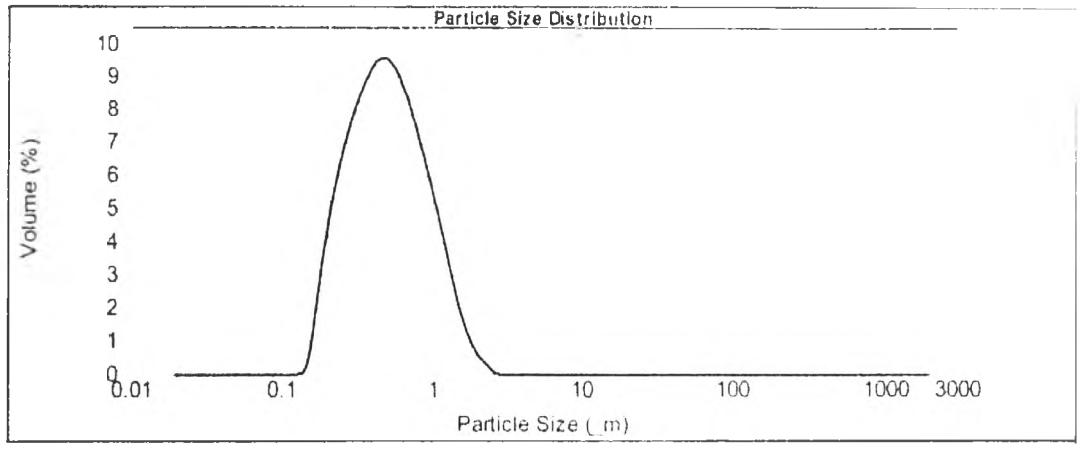

Figure d119. Particle size distribution of 20% bo+EPC+SA autoclaved emulsion

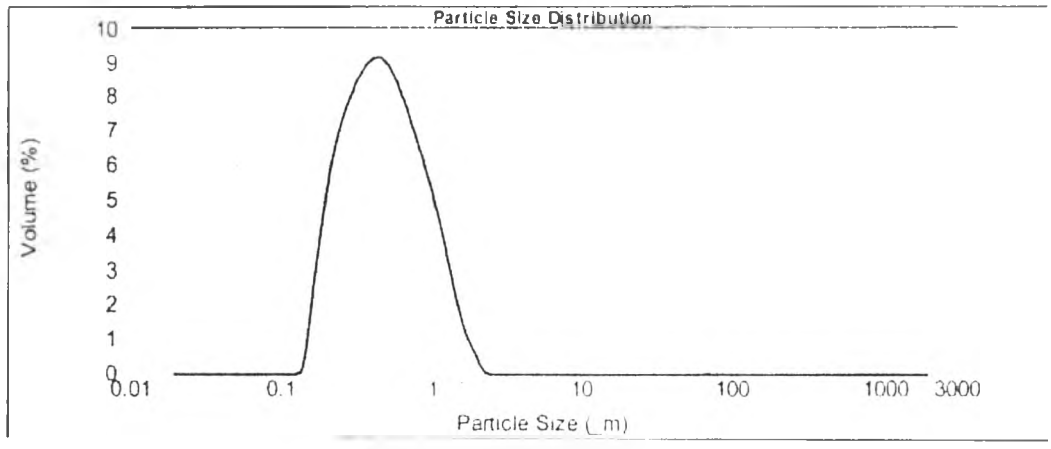

Figure d120. Particle size distribution of 20% bo+EPC+SA autoclaved emulsion after storage for 3 weeks

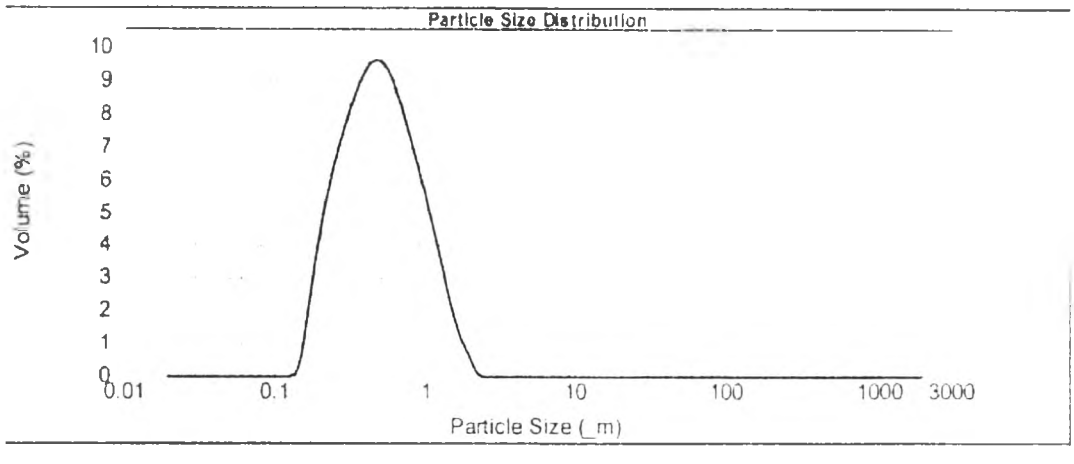

Figure d121. Particle size distribution of 20% bo+EPC+SA autoclaved emulsion after storage for 4 weeks

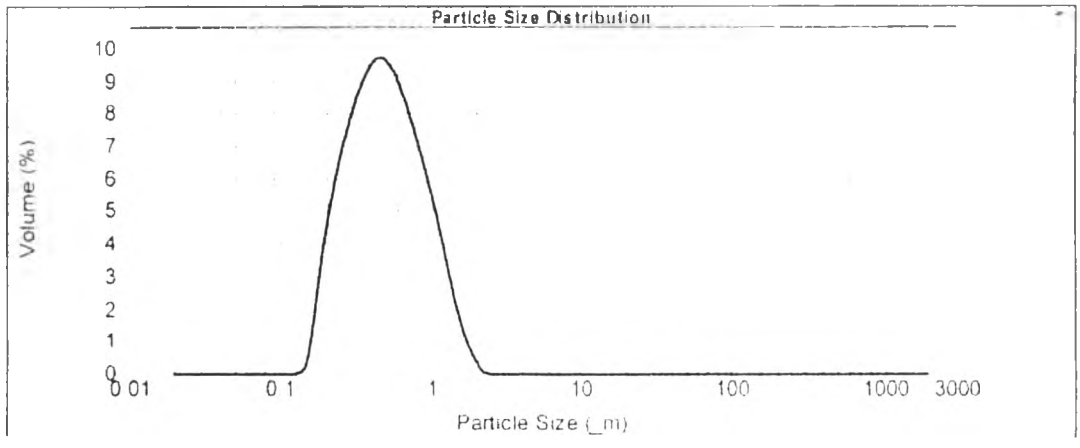

Figure d122. Particle size distribution of 20% bo+EPC+SA autoclaved emulsion after storage for 14 weeks

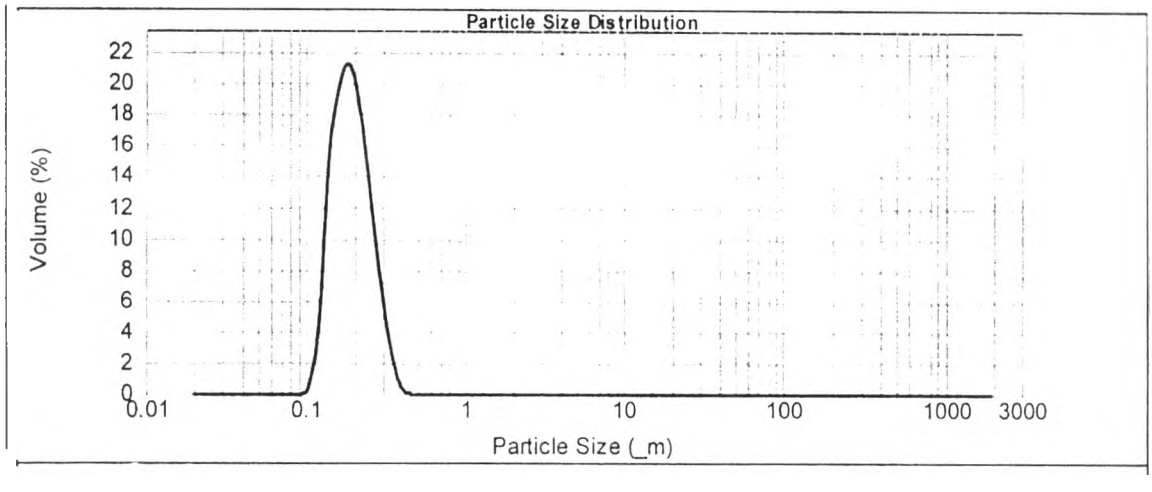

Figure d123. Particle size distribution of non-sterilized lipid emulsion containing oil-soluble vitamins using EPC+T80 as emulsifiers immediately after preparation

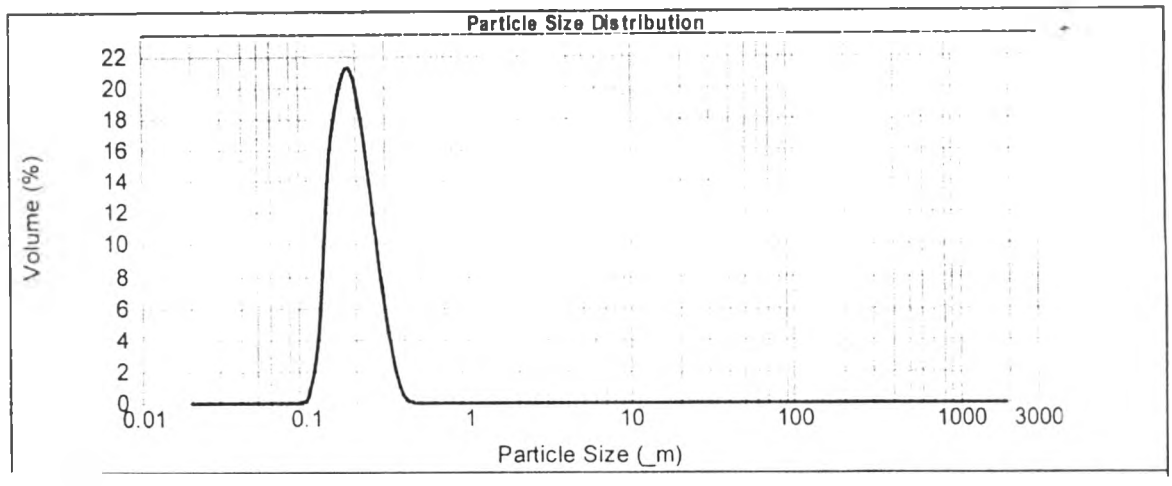

Figure d124. Particle size distribution of non-sterilized lipid emulsion containing oil-soluble vitamins using EPC+T80 as emulsifiers 1 week after preparation

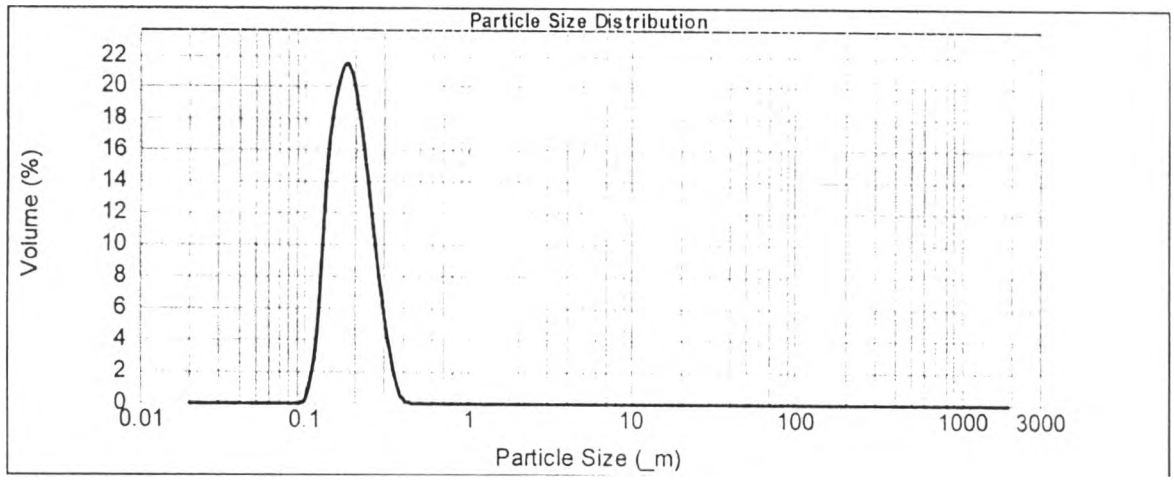

Figure d125. Particle size distribution of non-sterilized lipid emulsion containing oil-soluble vitamins using EPC+T80 as emulsifiers 1 month after preparation

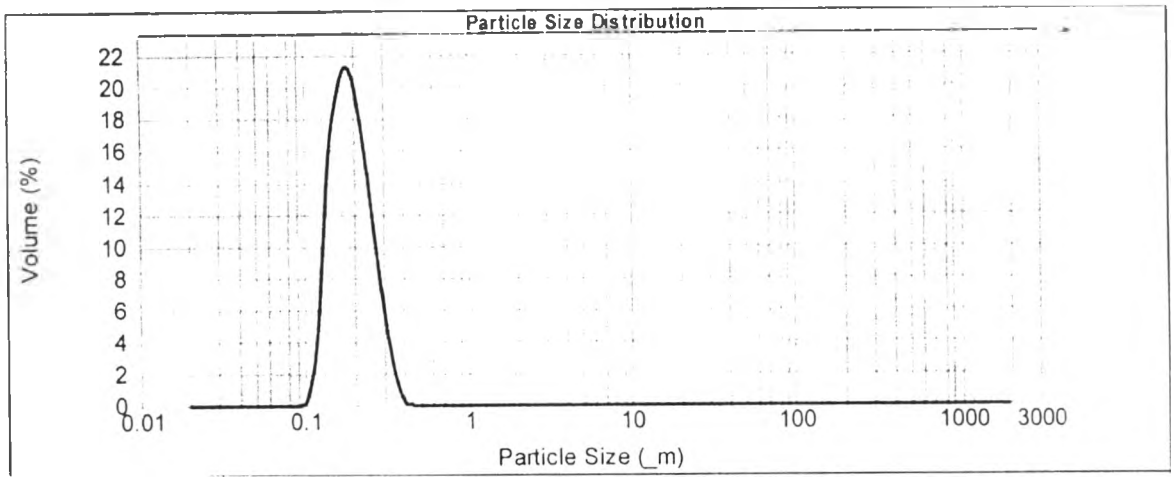

Figure d126. Particle size distribution of filtrated lipid emulsion containing oil-soluble vitamins using EPC+T80 as emulsifiers immediately after preparation

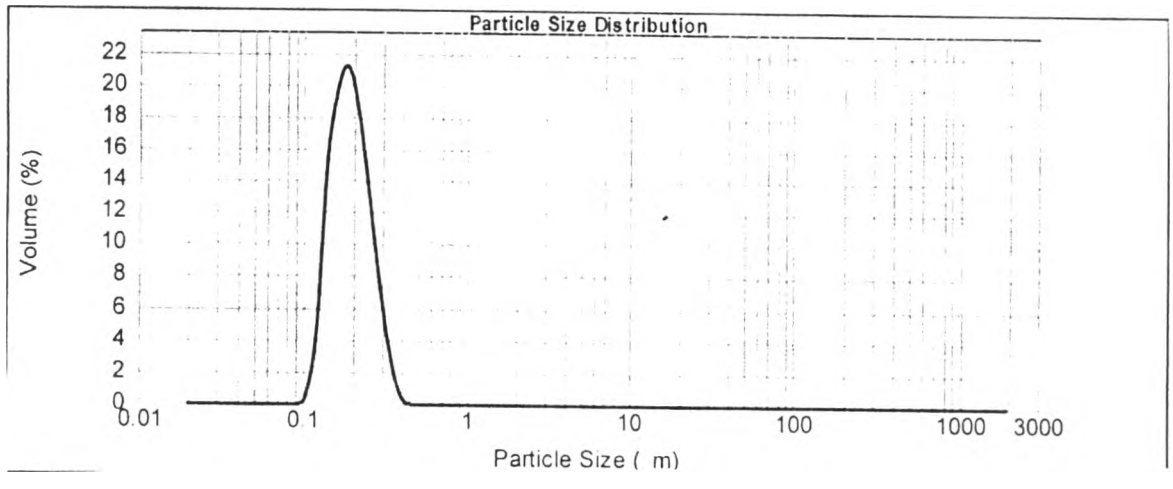

Figure d127. Particle size distribution of filtrated lipid emulsion containing oil-soluble vitamins using EPC+T80 as emulsifiers 1 week after preparation

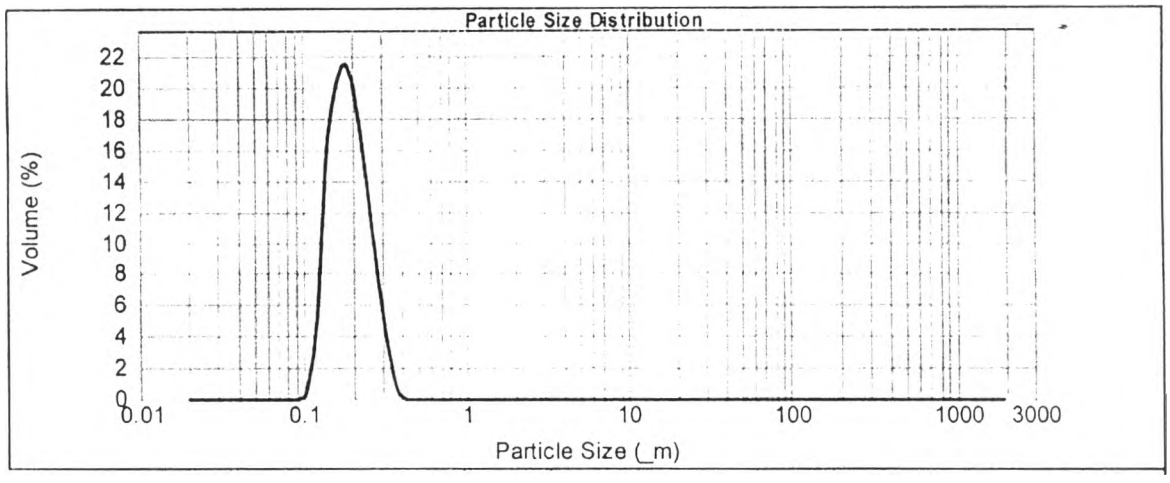

Figure d128. Particle size distribution of filtrated lipid emulsion containing oil-soluble vitamins using EPC+T80 as emulsifiers 1 month after preparation

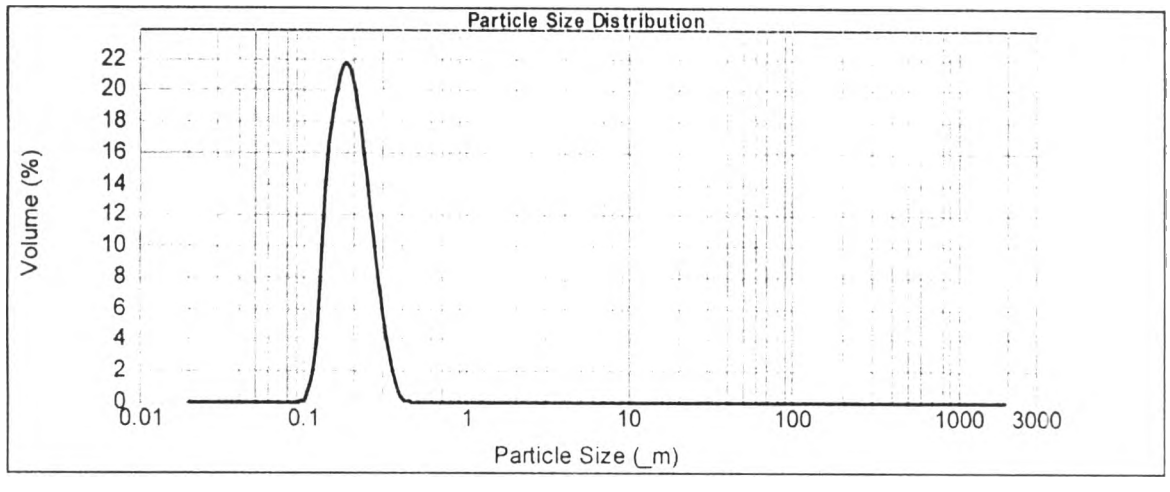

Figure d129. Particle size distribution of autoclaved lipid emulsion containing oil-soluble vitamins using EPC+T80 as emulsifiers immediately after preparation

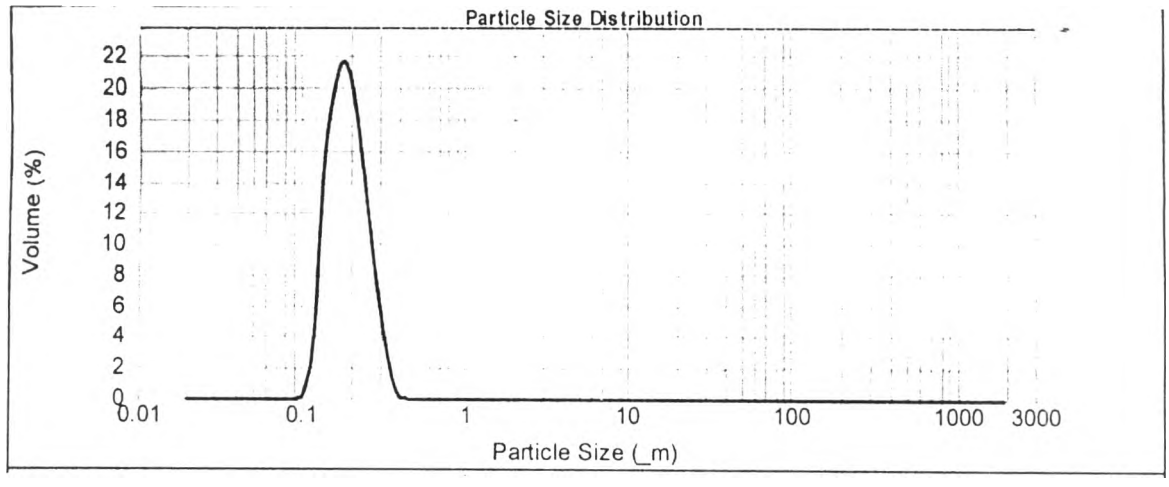

Figure d130. Particle size distribution of autoclaved lipid emulsion containing oil-soluble vitamins using EPC+T80 as emulsifiers 1 week after preparation

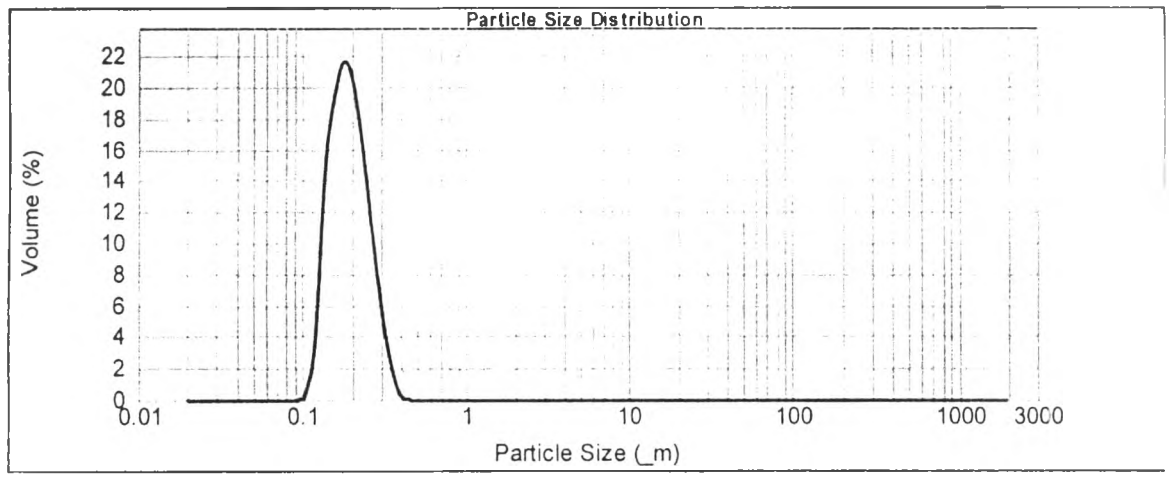

Figure d131. Particle size distribution of autoclaved lipid emulsion containing oil-soluble vitamins using EPC+T80 as emulsifiers 1 month after preparation

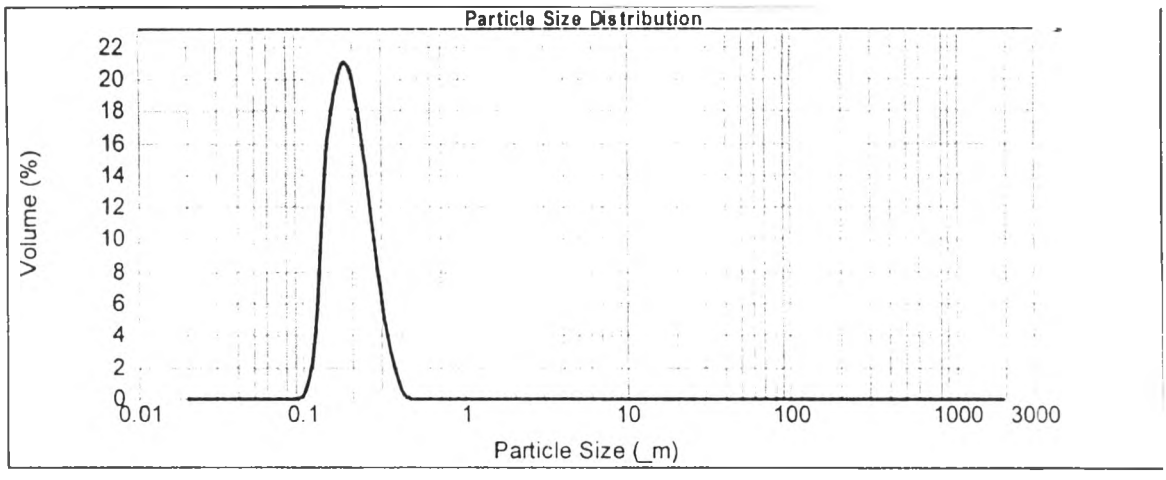

Figure d132. Particle size distribution of non-sterilized lipid emulsion containing oil-soluble vitamins using EPC+T80+PG as emulsifiers immediately after preparation

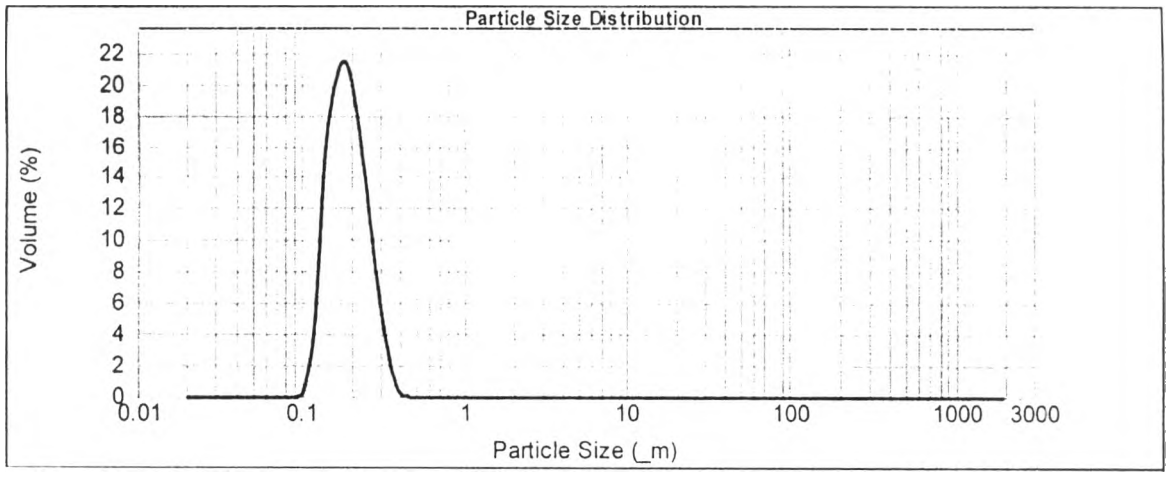

Figure d133. Particle size distribution of non-sterilized lipid emulsion containing oil-soluble vitamins using EPC+T80+PG as emulsifiers 1 week after preparation

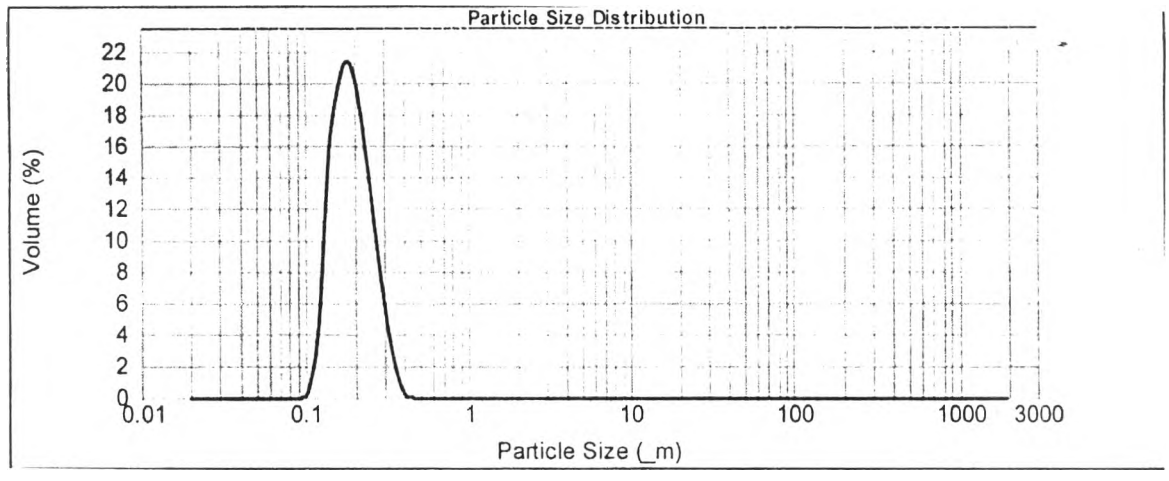

Figure d134. Particle size distribution of non-sterilized lipid emulsion containing oil-soluble vitamins using EPC+T80+PG as emulsifiers 1 month after preparation

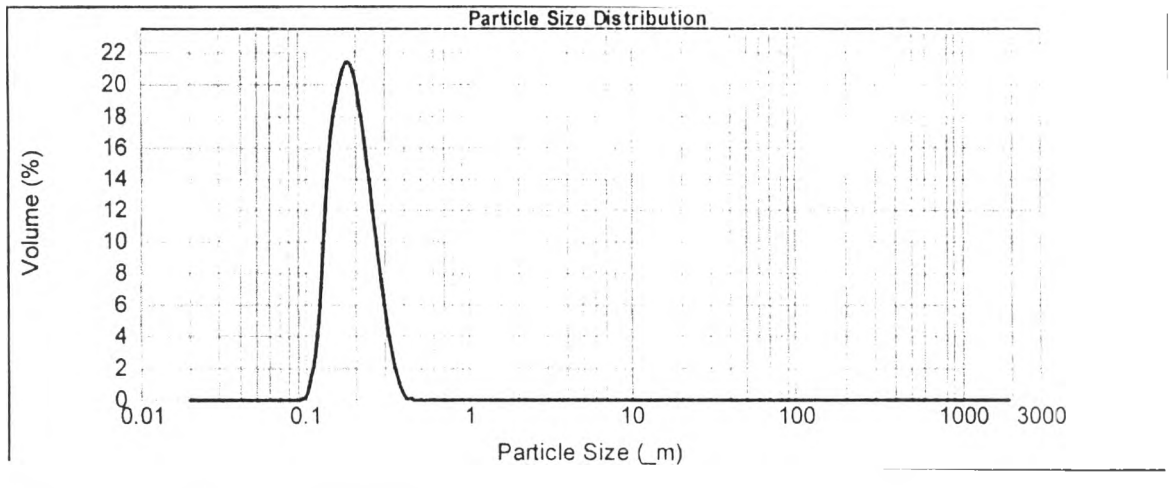

Figure d135. Particle size distribution of filtrated lipid emulsion containing oil-soluble vitamins using EPC+T80+PG as emulsifiers immediately after preparation

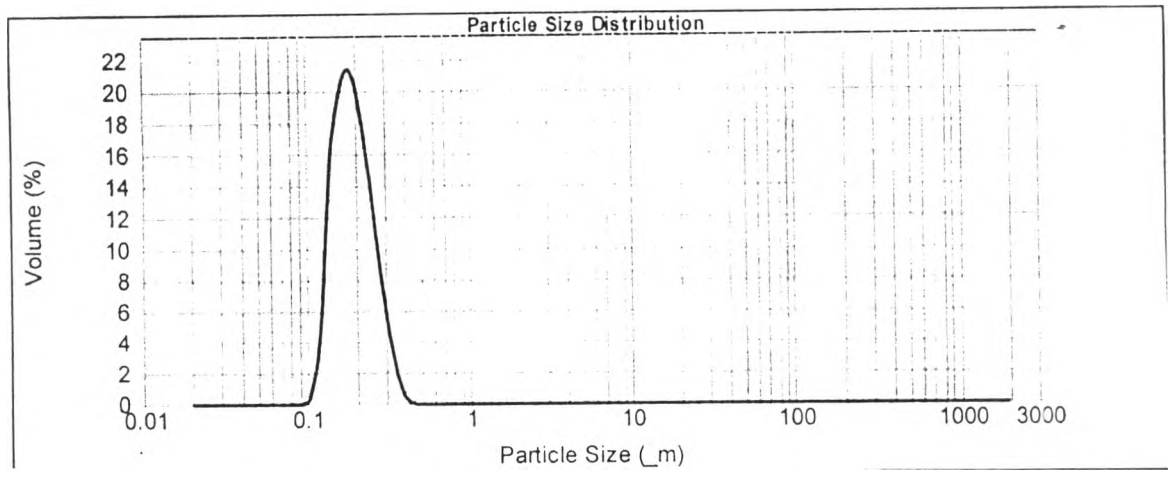

Figure d136. Particle size distribution of filtrated lipid emulsion containing oil-soluble vitamins using EPC+T80+PG as emulsifiers 1 week after preparation

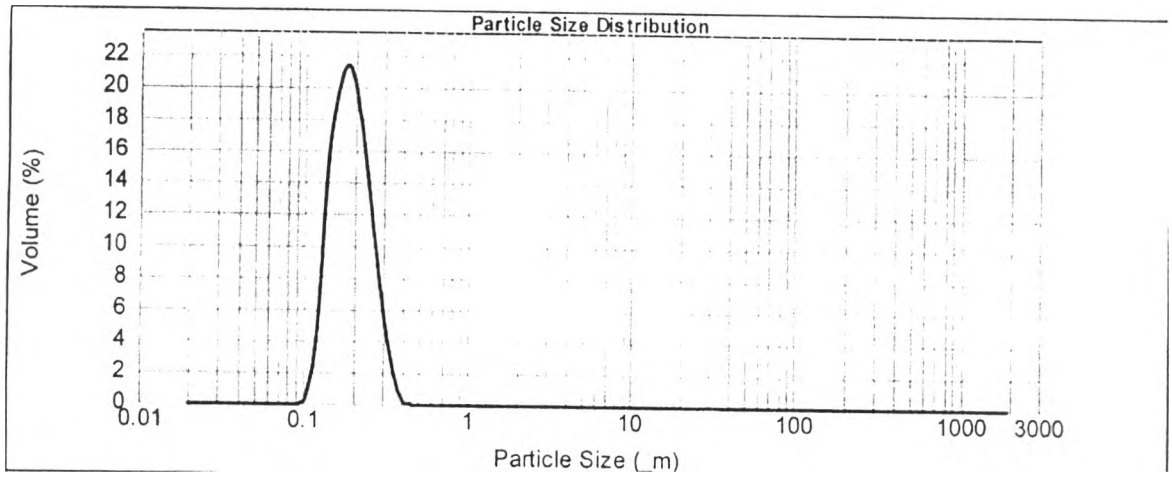

Figure d137. Particle size distribution of filtrated lipid emulsion containing oil-soluble vitamins using EPC+T80+PG as emulsifiers 1 month after preparation

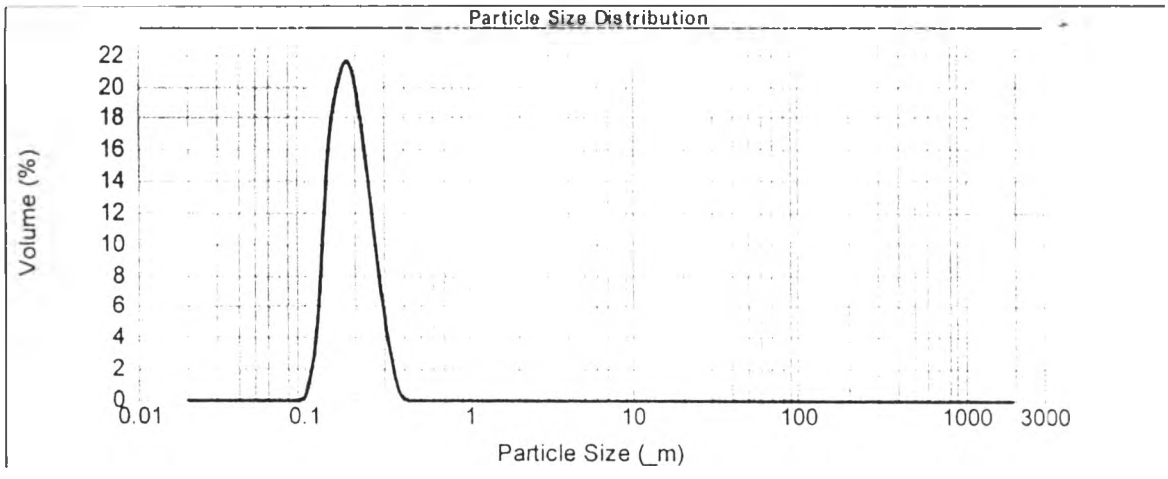

Figure d138. Particle size distribution of autoclaved lipid emulsion containing oil-soluble vitamins using EPC+T80+PG as emulsifiers immediately after preparation

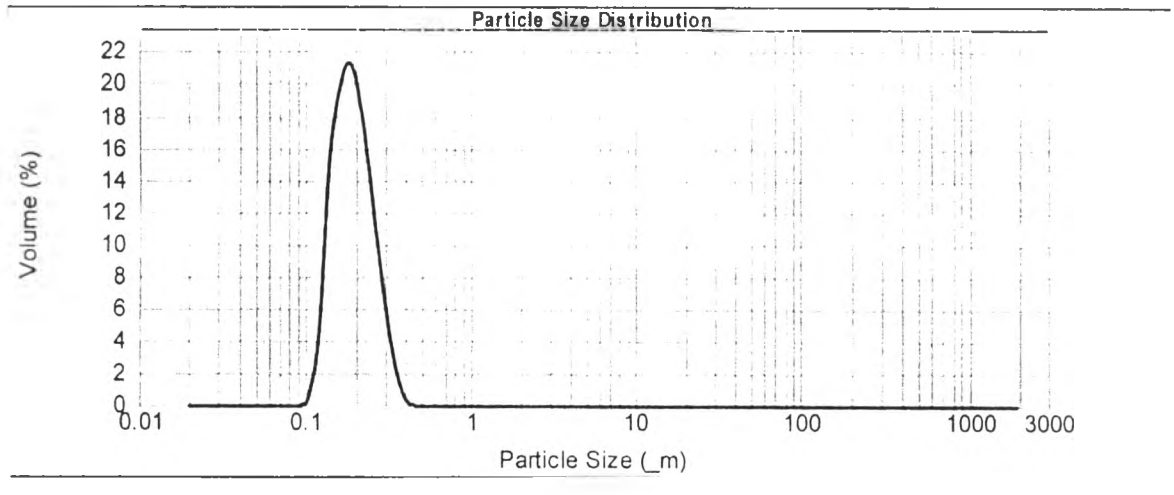

Figure d139. Particle size distribution of autoclaved lipid emulsion containing oil-soluble vitamins using EPC+T80+PG as emulsifiers 1 week after preparation

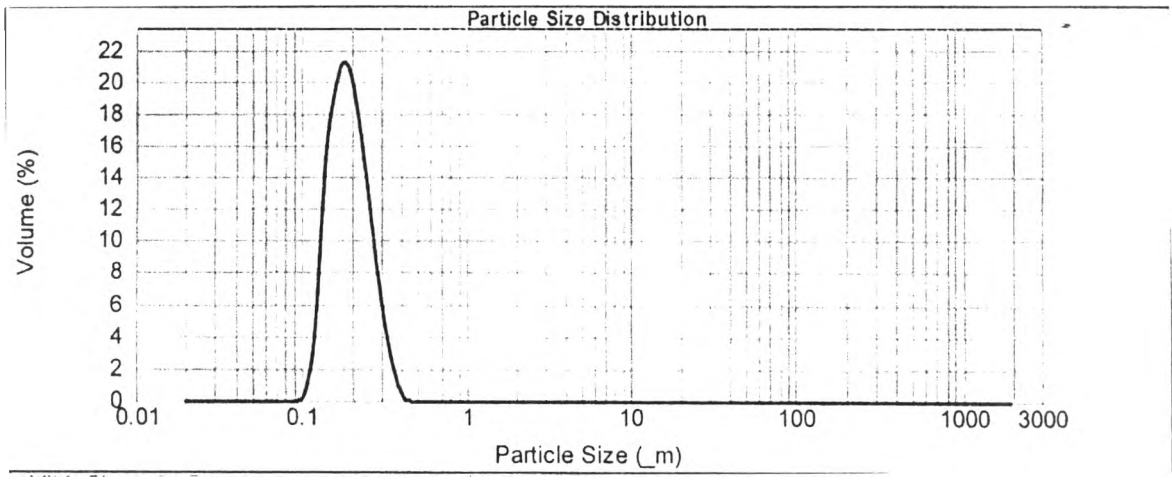

Figure d140. Particle size distribution of autoclaved lipid emulsion containing oil-soluble vitamins using EPC+T80+PG as emulsifiers 1 month after preparation

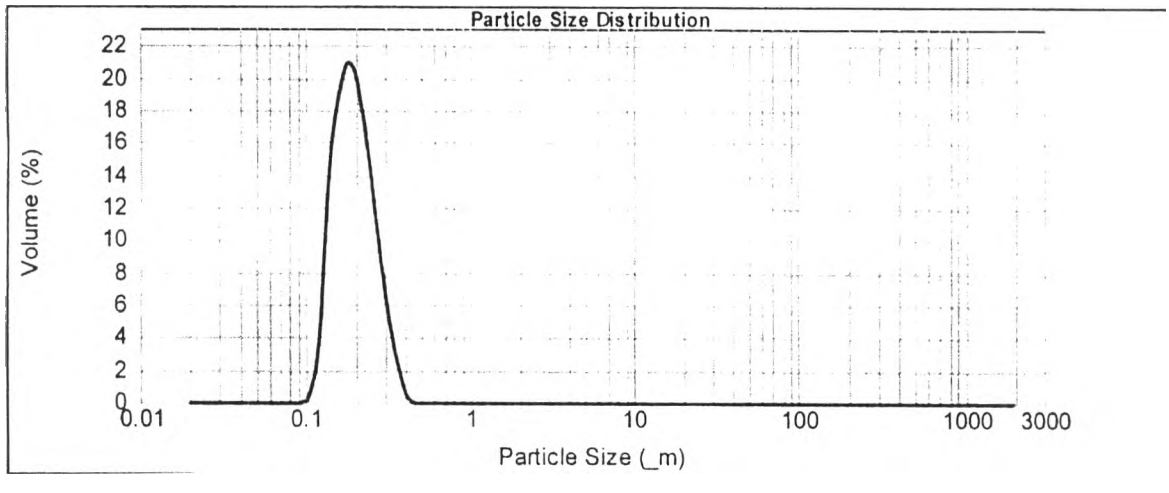

Figure d141. Particle size distribution of non-sterilized lipid emulsion containing oil-soluble vitamins using EPC+T80+SA as emulsifiers immediately after preparation

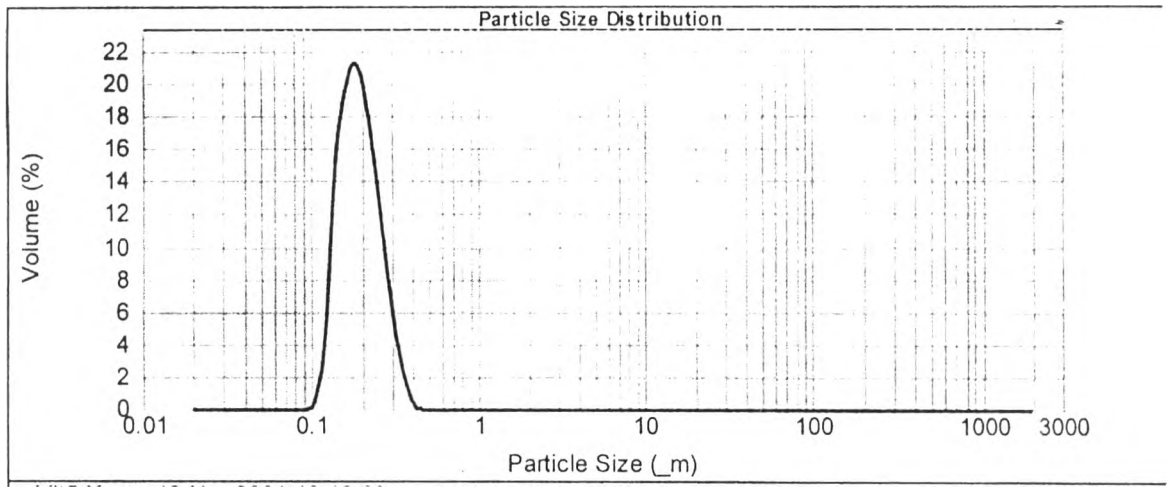

Figure d142. Particle size distribution of non-sterilized lipid emulsion containing oil-soluble vitamins using EPC+T80+SA as emulsifiers 1 week after preparation

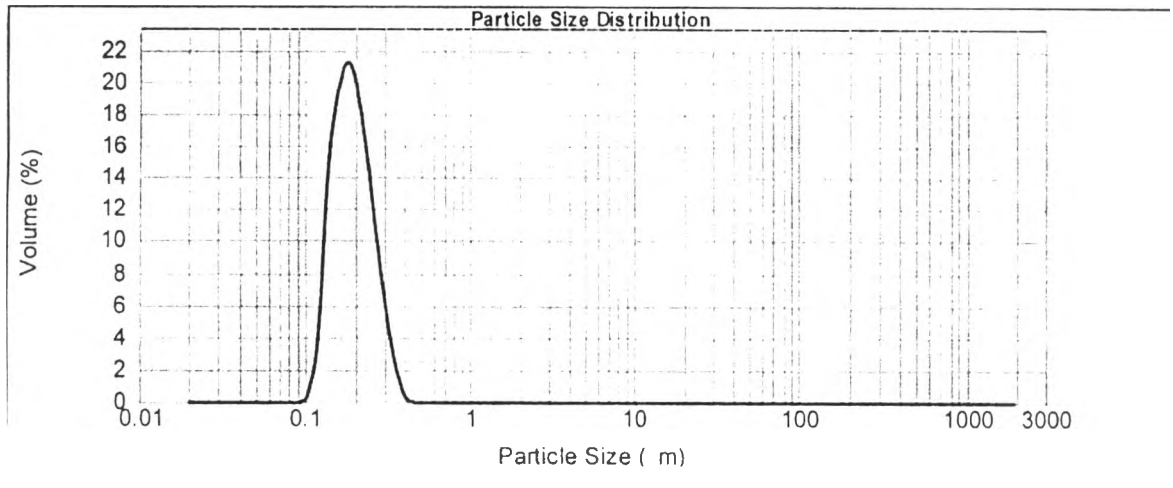

Figure d143. Particle size distribution of non-sterilized lipid emulsion containing oil-soluble vitamins using EPC+T80+SA as emulsifiers 1 month after preparation

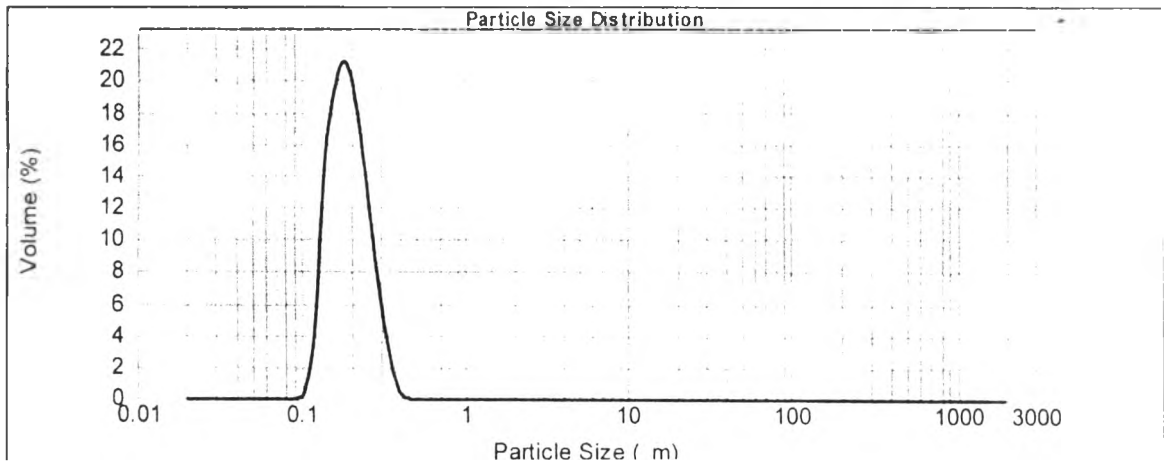

Figure d144. Particle size distribution of filtrated lipid emulsion containing oil-soluble vitamins using EPC+T80+SA as emulsifiers immediately after preparation

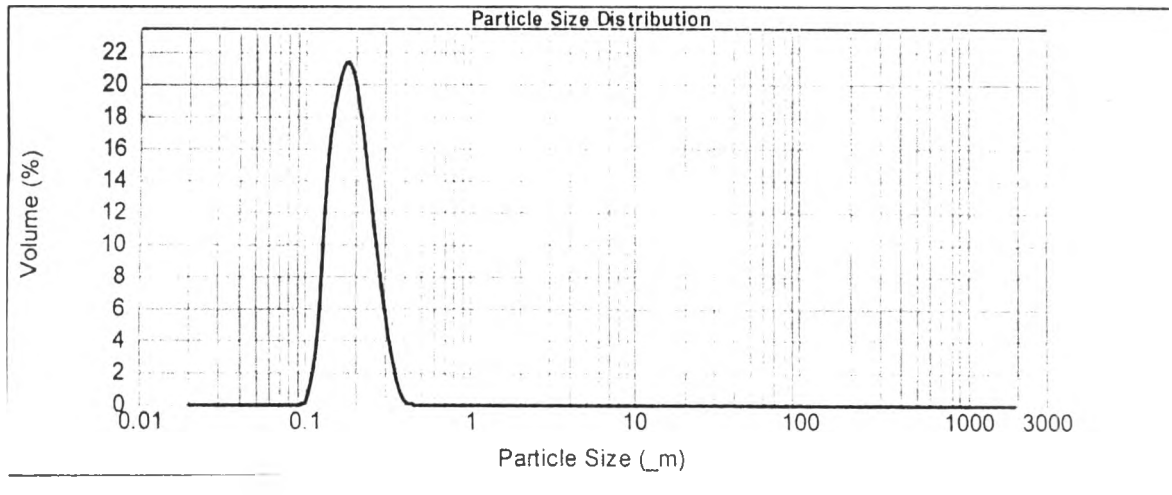

Figure d145. Particle size distribution of filtrated lipid emulsion containing oil-soluble vitamins using EPC+T80+SA as emulsifiers 1 week after preparation

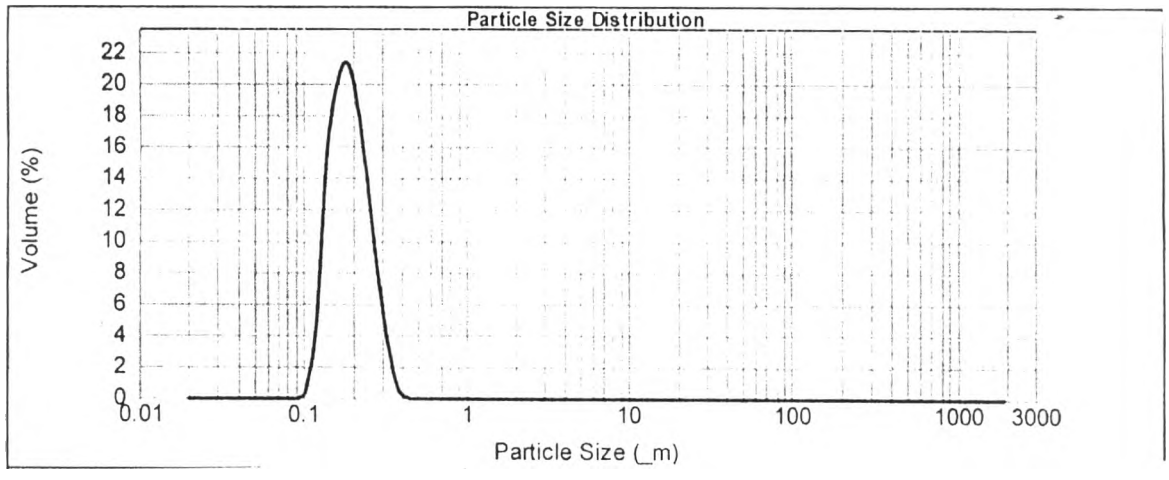

Figure d146. Particle size distribution of filtrated lipid emulsion containing oil-soluble vitamins using EPC+T80+SA as emulsifiers 1 month after preparation

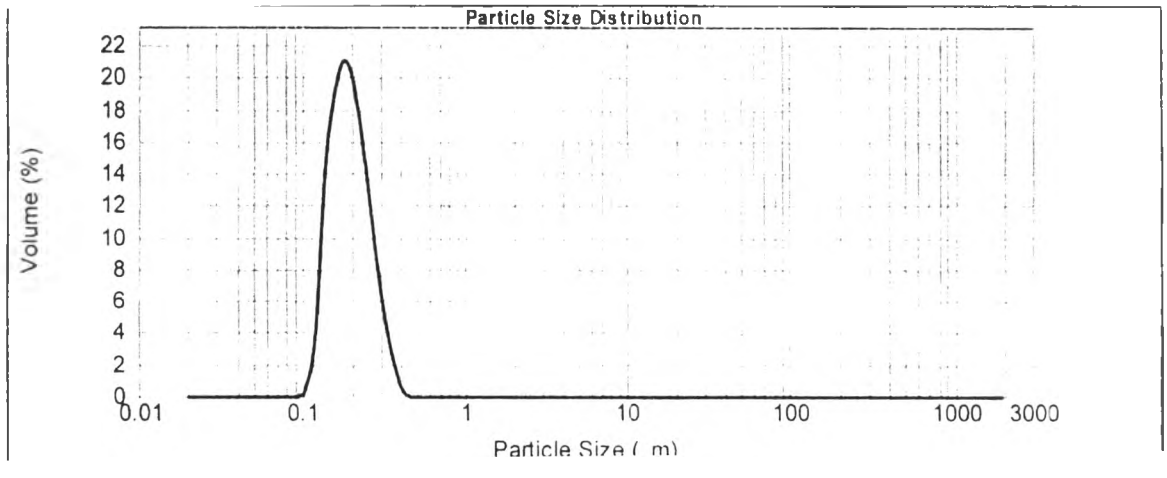

Figure d147. Particle size distribution of autoclaved lipid emulsion containing oil-soluble vitamins using EPC+T80+SA as emulsifiers immediately after preparation

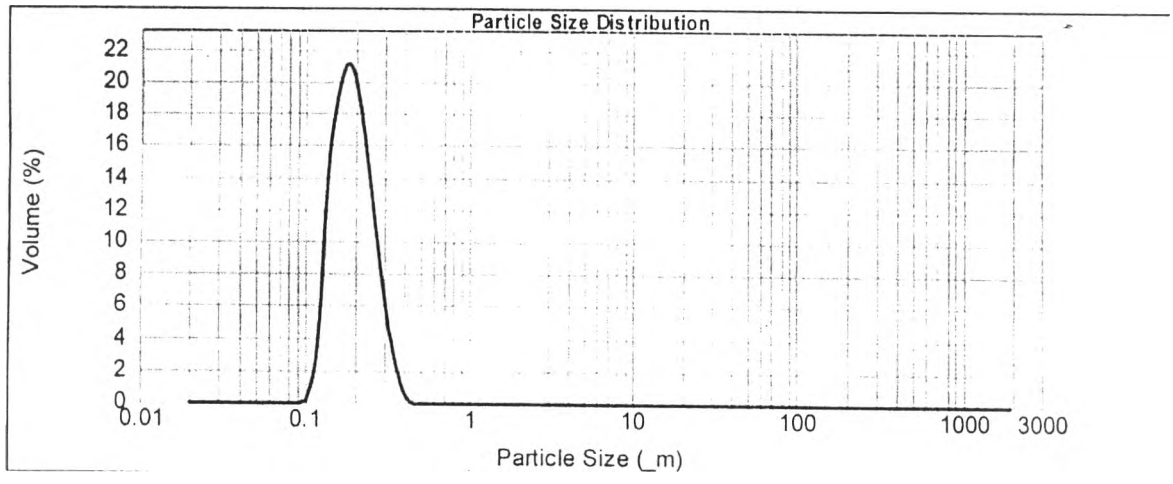

Figure d148. Particle size distribution of autoclaved lipid emulsion containing oil-soluble vitamins using EPC+T80+SA as emulsifiers 1 week after preparation

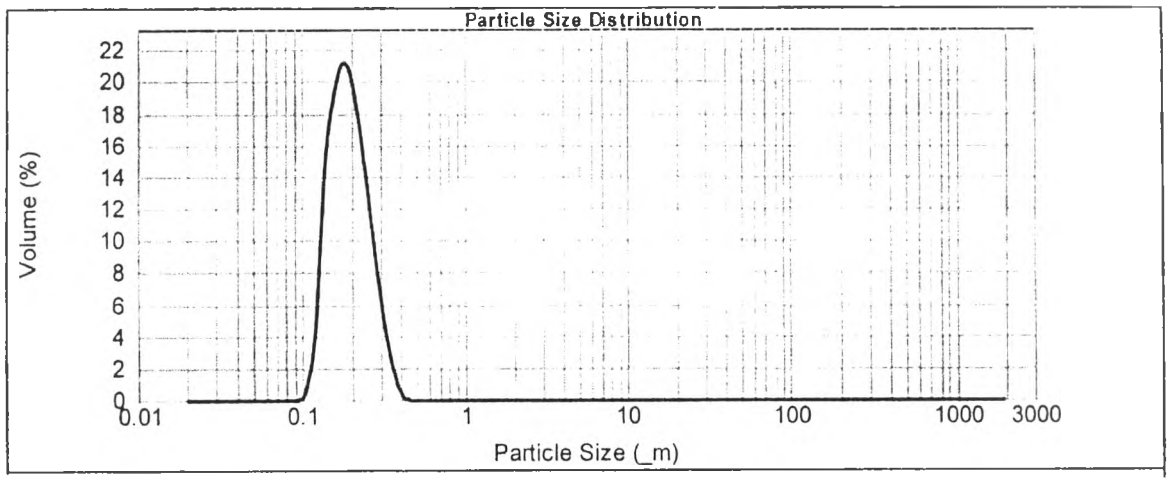

Figure d149. Particle size distribution of autoclaved lipid emulsion containing oil-soluble vitamins using EPC+T80+SA as emulsifiers 1 month after preparation

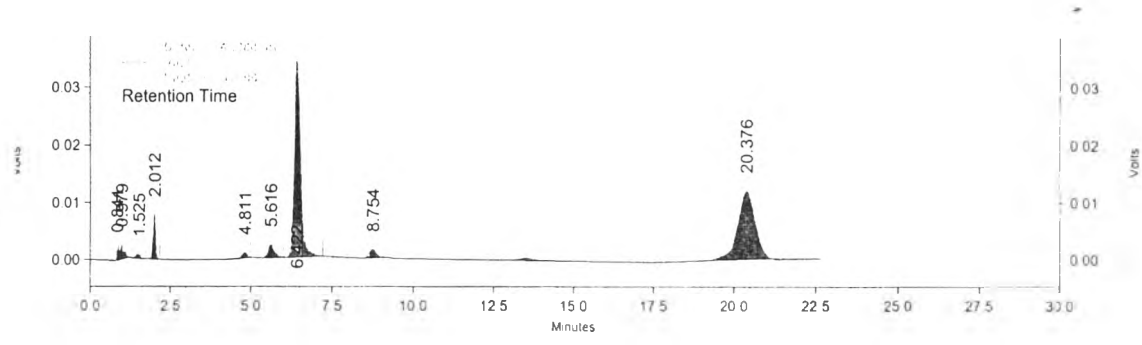

Figure e1. Chromatogram of commercial emulsion, Vitalipid

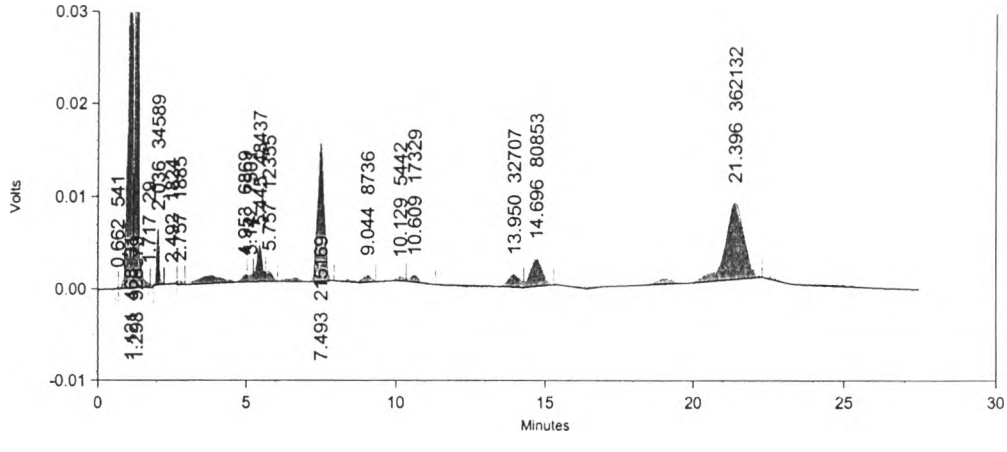

Figure e2. Chromatogram of emulsion formulated using 10% soybean oil and emulsified by EPC+T80+PG after preparation for 48 hours

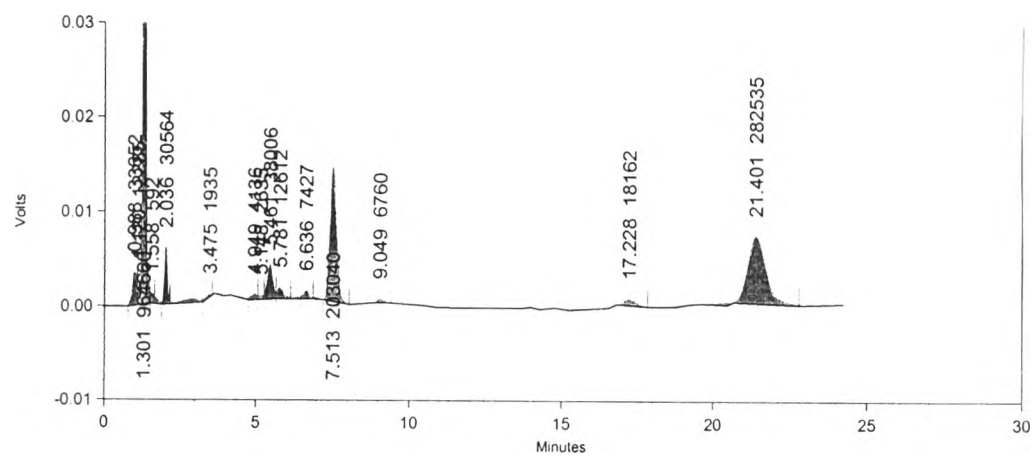

Figure e3. Chromatogram of emulsion formulated using 10% soybean oil and emulsified by EPC+T80+SA after preparation for 48 hours

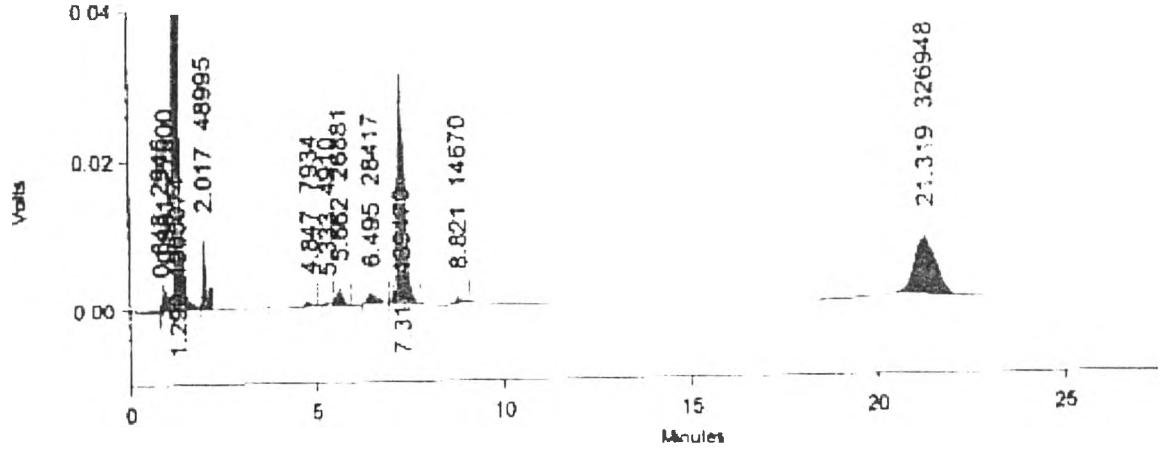

Figure e4. Chromatogram of filtrated emulsion formulated using 10% soybean oil and emulsified by EPC+T80 after preparation for 2 months

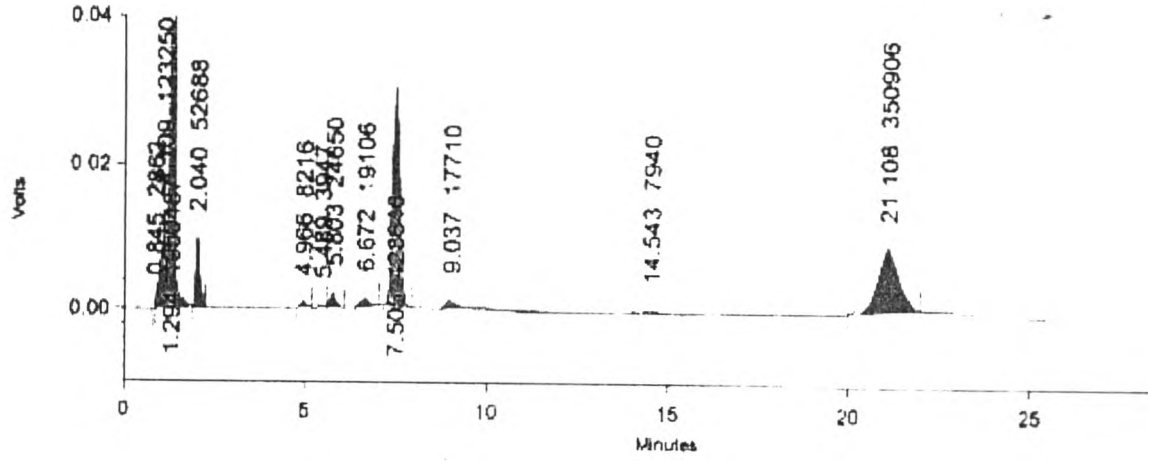

Figure e5. Chromatogram of autoclaved emulsion formulated using 10% soybean oil and emulsified by EPC+T80 after preparation for 2 months

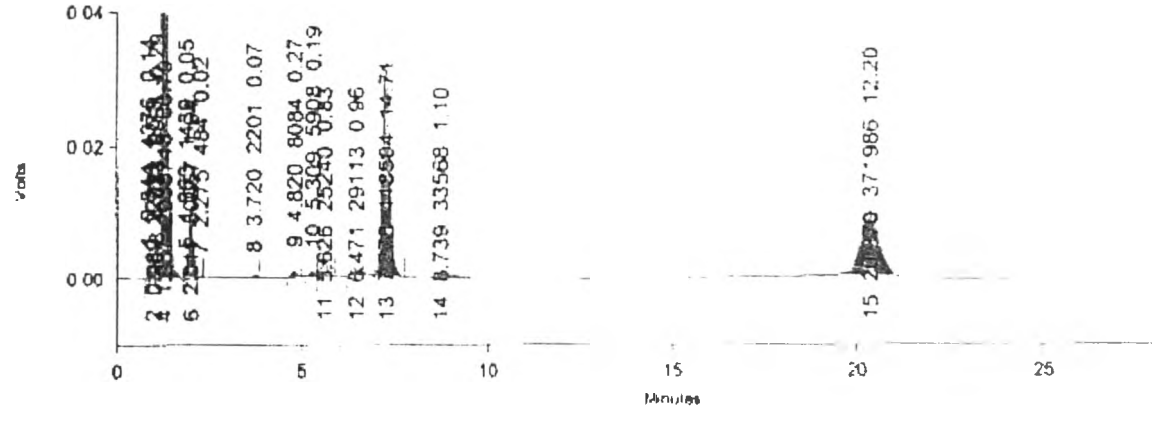

Figure e6. Chromatogram of filtrated emulsion formulated using 10% soybean oil and emulsified by EPC+T80+PG after preparation for 2 months

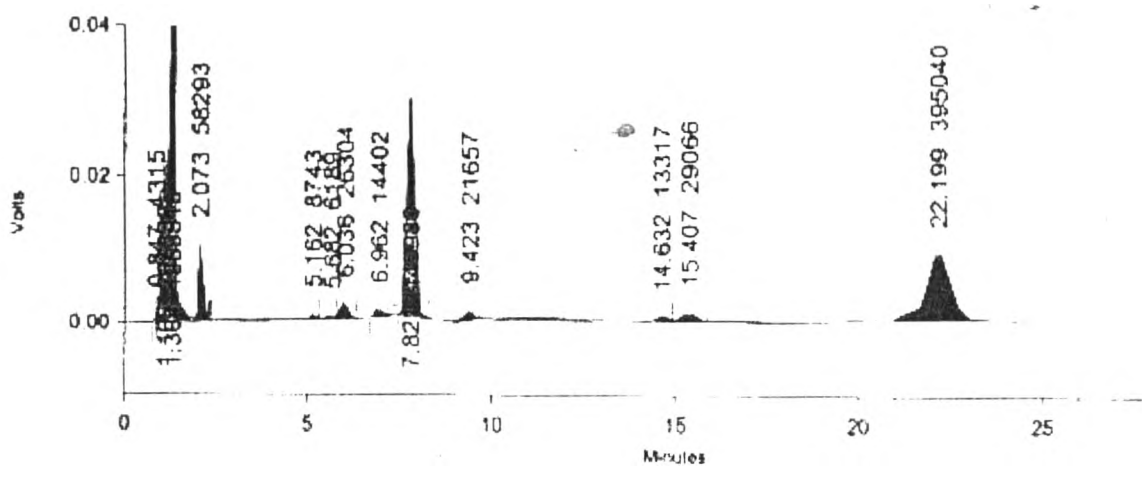

Figure e7. Chromatogram of autoclaved emulsion formulated using 10% soybean oil and emulsified by EPC+T80+PG after preparation for 2 months

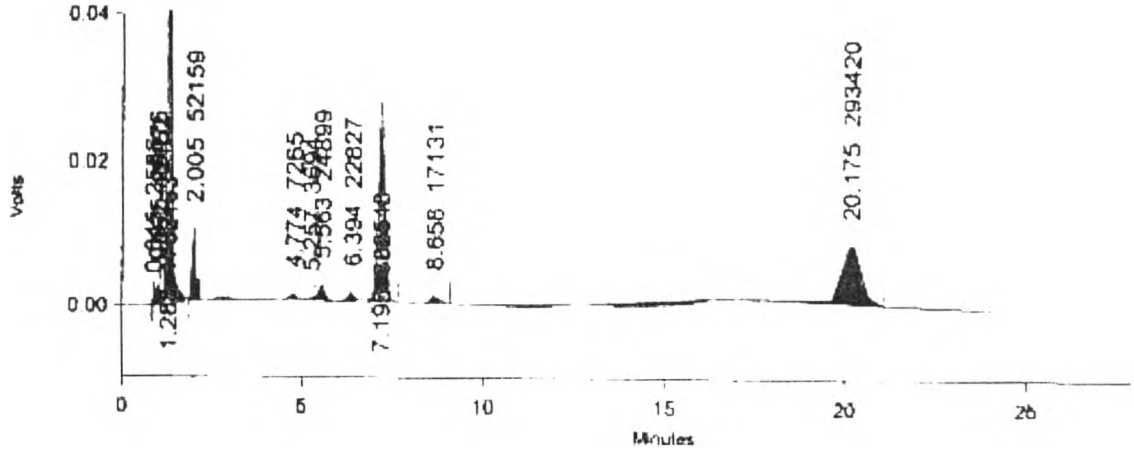

Figure e8. Chromatogram of filtrated emulsion formulated using 10% soybean oil and emulsified by EPC+T80+SA after preparation for 2 months

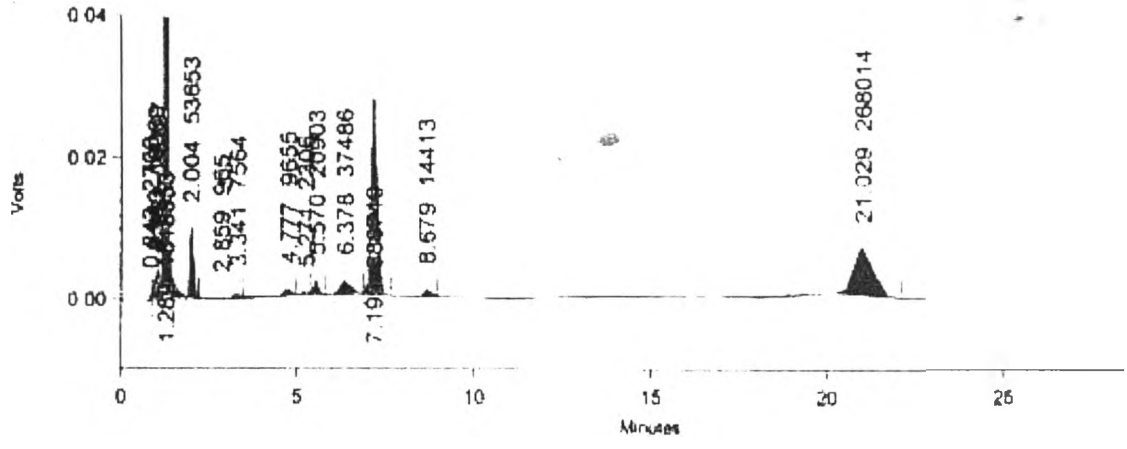

Figure e9. Chromatogram of autoclaved emulsion formulated using 10% soybean oil and emulsified by EPC+T80+SA after preparation for 2 months

BIOGRAPHY

Miss Nuntana Candido was born on May 5, 1975 in Bangkok, Thailand. She received her Bachelor of Science in Pharmacy from the Faculty of Pharmacy, Chulalongkorn University, Bangkok, Thailand in 1998. Currently, she is working as a medical representative at B.L.H Trading Co., LTD.