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APPENDIX

Analysis of aldehydes-DNPH by HPLC

In this research, DNPH and aldehydes-DNPH were analyzed by HPLC technique. Five aldehyde species were studied including formaldehyde, acetaldehyde, propanal, butanal and hexanal. The aldehydes analysis was achieved within 30 min. The calibration curves of aldehydes were obtained by using the standard solutions of aldehydes-DNPH. The x-axis is time separation and the y-axis is absorption units of analytes as shown in Figure A-1 and Figure A-2.

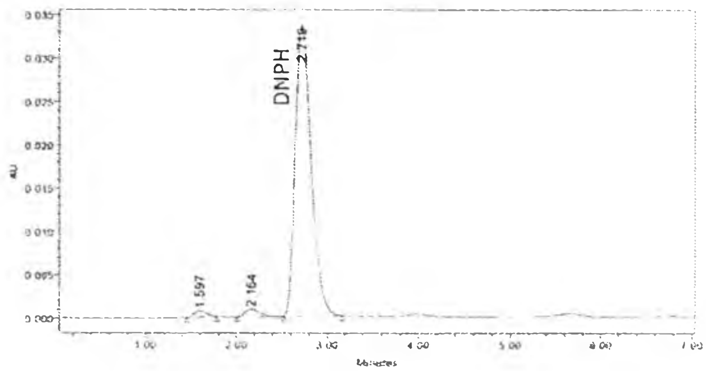


Figure A-1 HPLC chromatogram of the DNPH analysis from membrane coating.

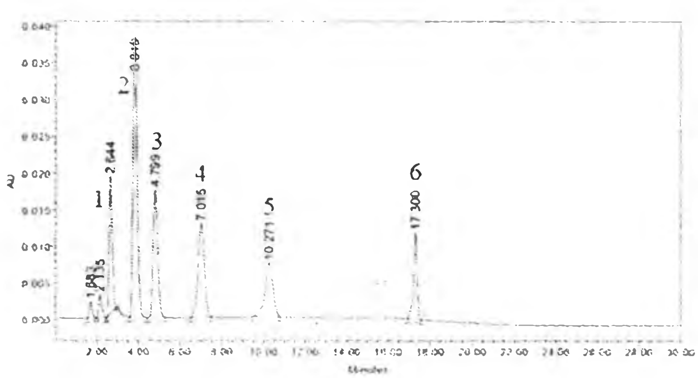
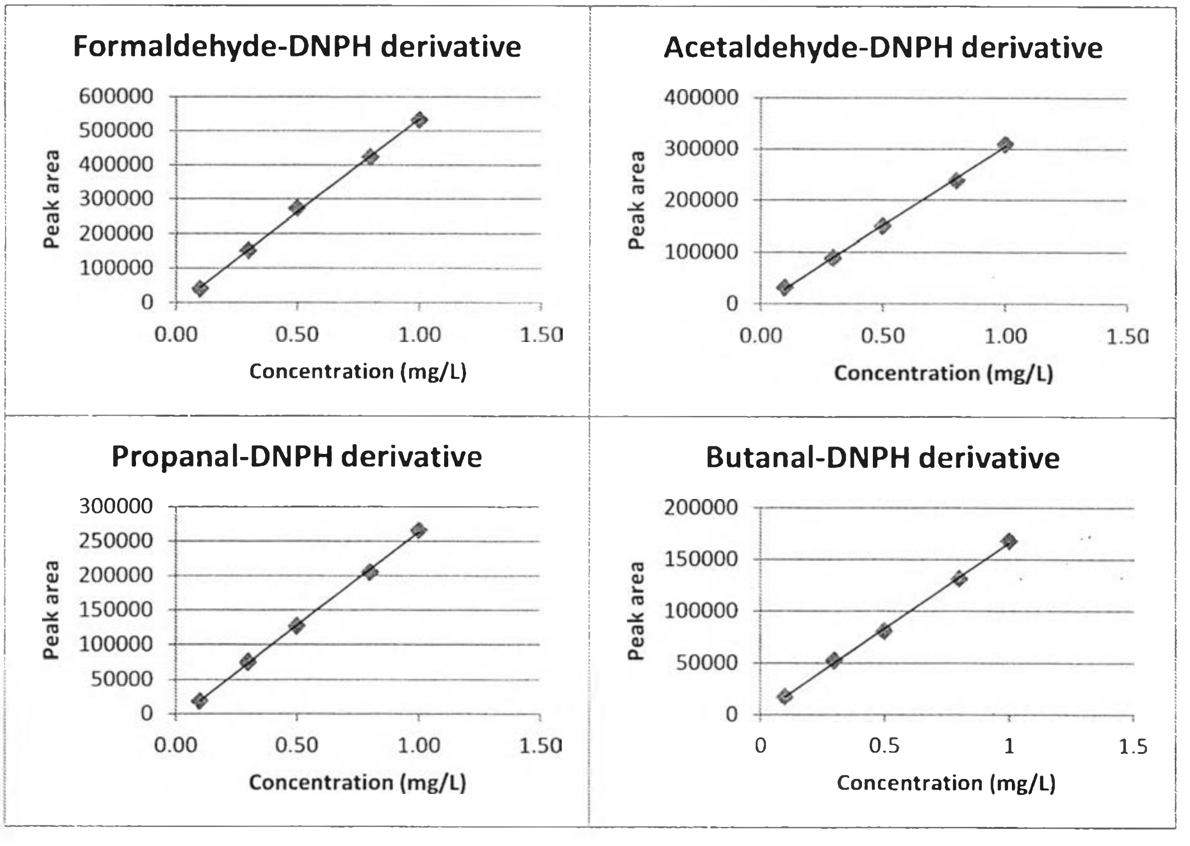


Figure A-2 HPLC chromatogram of the aldehydes-DNPH analysis at 1 mg/L. Identification of peaks: (1) DNPH, (2) formaldehyde-DNPH, (3) acetaldehyde-DNPH, (4) propanal-DNPH, (5) butanal-DNPH and (6) hexanal-DNPH.

In this study, five different concentrations of the aldehydes standard solutions were analyzed to prepare the calibration curve, which were 0.10, 0.30, 0.50, 0.80 and 1.00 mg/L. The calibration curve of aldehydes had a good linearity which had the equation and R^2 as shown in Table A-1.

Table A-1 Equation and R^2 value of calibration curve for aldehydes.

Reagent	Equation	R^2
formaldehyde	y = 544371x - 10938	R^2 = 0.9990
acetaldehyde	y = 306457x - 2590	R^2 = 0.9988
propanal	y = 271705x - 8940	R^2 = 0.9992
butanal	y =165188x + 293	R^2 = 0.9988
hexanal	y = 77931x - 5356	R^2 = 0.9966



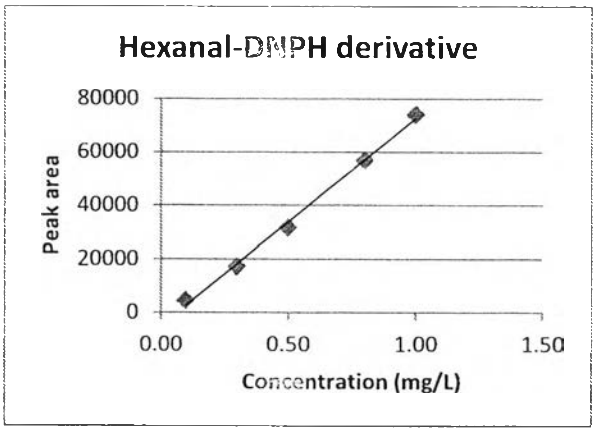


Figure A-3 Calibration curve of aldehydes-DNPH derivative analysis by HPLC

Table A-2 Peak area of DNPH when coating with different concentration of DNPH in ACN solvent.

DNPH concentration in ACN solvent	Peak Area			mean	SD
	Trial 1	Trial 2	Trial 3		
100 mg/L	61883	55825	53451	57053	4348
200 mg/L	128414	98463	92863	106580	19115
300 mg/L	143068	136825	139666	139853	3126
400 mg/L	187360	180356	186921	184879	3923
500 mg/L	192579	184632	188148	188453	3982

Table A-3 Peak area of DNPH when coating with different concentration of DNPH in water:ACN solvent.

DNPH concentration in water:ACN solvent	Peak Area			mean	SD
	Trial 1	Trial 2	Trial 3		
100 mg/L	121228	101363	101636	108076	11391
200 mg/L	141945	169524	157464	156311	13826
300 mg/L	219129	231543	232425	227699	7435
400 mg/L	204579	231736	234121	223479	16411
500 mg/L	219105	258551	201972	226543	29014

Table A-4 Peak area of DNPH at various coating rate.

Coating rate (μL/min)	Peak Area			mean	SD
	Trial 1	Trial 2	Trial 3		
60	204839	259232	239297	234456	27518
75	247057	216980	237398	233812	15356
100	235128	241073	236799	237667	3066
150	207635	180447	180685	189589	15629
300	159835	144779	139440	148018	10576

Table A-5 Peak area of aldehydes-DNPH-derivatives with different desorption solvent by using nylon6 as the sorbent.

Desorption solvents	Reagents	Peak Area			mean	SD
		Trial 1	Trial 2	Trial 3		
ACN	formaldehyde	427653	483480	461643	457592	28133
	acetonitrile	327058	270846	279335	292413	30302
	propanal	194637	237059	211309	214335	21372
	butanal	56980	84773	76602	72785	14284
	hexanal	39713	25793	35345	33617	7119
MeOH	formaldehyde	263740	223910	248460	245370	20094
	acetonitrile	246914	194721	202102	214579	28245
	propanal	221834	180252	201439	200647	20792
	butanal	29524	20515	23980	24673	4544
	hexanal	6021	9682	9593	8432	2088
Hexane	formaldehyde	163289	117822	163960	148357	26446
	acetonitrile	107329	152795	133756	126368	22833
	propanal	93846	123552	95577	104325	16674
	butanal	ND	ND	ND	ND	ND
	hexanal	ND	ND	ND	ND	ND

ND: not detected.

Table A-6 Peak area of aldehydes-DNPH-derivatives with different desorption solvent by using PS as the sorbent.

Desorption solvents	Reagents	Peak Area			mean	SD
		Trial 1	Trial 2	Trial 3		
ACN	formaldehyde	402396	364201	391106	385901	19622
	acetonitrile	276844	217940	200145	231643	40144
	propanal	146936	105794	110255	120995	22576
	butanal	39647	69211	43158	50672	16151
	hexanal	15974	23693	26243	21970	5347
MeOH	formaldehyde	237935	184836	199897	207556	27366
	acetonitrile	217743	174579	188649	193657	22013
	propanal	125848	94737	82052	100879	22535
	butanal	18588	12456	16041	15695	3081
	hexanal	7564	4783	5212	5853	1497
Hexane	formaldehyde	137932	103258	111559	117583	18105
	acetonitrile	97324	89347	97348	94673	4612
	propanal	68302	65218	64729	66083	1937
	butanal	ND	ND	ND	ND	ND
	hexanal	ND	ND	ND	ND	ND

ND: not detected.

Table A-7 Peak area of aldehydes-DNPH-derivatives with different desorption solvent by using PAN as the sorbent.

Desorption solvents	Reagents	Peak Area			mean	SD
		Trial 1	Trial 2	Trial 3		
ACN	formaldehyde	249584	294738	317302	287208	34481
	acetonitrile	204893	174939	199291	193041	15925
	propanal	135616	98490	113924	116010	18651
	butanal	29589	23793	27831	27071	2972
	hexanal	5842	9578	10464	8628	2453
MeOH	formaldehyde	137827	174993	147461	153427	19288
	acetonitrile	103482	148293	133860	128545	22873
	propanal	84732	105926	105538	98732	12126
	butanal	8845	11924	8514	9761	1881
	hexanal	5023	7292	4893	5736	1349
Hexane	formaldehyde	90348	97329	92160	93279	3623
	acetonitrile	59282	64020	63280	62194	2549
	propanal	37284	48025	51293	45534	7329
	butanal	ND	ND	ND	ND	ND
	hexanal	ND	ND	ND	ND	ND

ND: not detected.

Table A-8 Peak area of aldehydes-DNPH-derivatives with various ACN desorption volume by using nylon6 as the sorbent.

Desorption volume	Reagents	Peak Area			mean	SD
		Trial 1	Trial 2	Trial 3		
100 µL	formaldehyde	427653	483480	461643	457592	28133
	acetonitrile	327058	270846	279335	292413	30302
	propanal	194637	237059	211309	214335	21372
	butanal	56980	84773	76602	72785	14284
	hexanal	39713	25793	35345	33617	7119
200 µL	formaldehyde	208923	263424	271059	247802	33886
	acetonitrile	179024	207313	184821	190386	14943
	propanal	89452	97465	97279	94732	4574
	butanal	29574	33654	31824	31684	2044
	hexanal	10747	13553	12441	12247	1413
300 µL	formaldehyde	137892	94732	95594	109406	24673
	acetonitrile	93380	84324	99646	92450	7703
	propanal	41567	37574	38945	39362	2029
	butanal	10467	14674	13649	12930	2194
	hexanal	5745	6751	6059	6437	515

Table A-9 Peak area of aldehydes-DNPH-derivatives with various ACN desorption volume by using PS as the sorbent.

Desorption volume	Reagents	Peak Area			mean	SD
		Trial 1	Trial 2	Trial 3		
100 µL	formaldehyde	402396	364201	391106	385901	19622
	acetonitrile	276844	217940	200145	231643	40144
	propanal	146936	105794	110255	120995	22576
	butanal	39647	69211	43158	50672	16151
	hexanal	15974	23693	26243	21970	5347
200 µL	formaldehyde	174261	204623	174409	184431	17487
	acetonitrile	107462	158932	151932	139442	27916
	propanal	64799	69478	68817	67698	2532
	butanal	20482	24792	19778	21684	2715
	hexanal	9178	9834	9329	9447	344
300 µL	formaldehyde	66249	62894	59866	63003	3193
	acetonitrile	47953	41793	43031	44259	3258
	propanal	14892	10458	13032	12794	2227
	butanal	12789	8963	9841	10531	2004
	hexanal	6184	5392	5848	5808	398

Table A-10 Peak area of aldehydes-DNPH-derivatives with various ACN desorption volume by using PAN as the sorbent.

Desorption volume	Reagents	Peak Area			mean	SD
		Trial 1	Trial 2	Trial 3		
100 µL	formaldehyde	249584	294738	317302	287208	34481
	acetonitrile	204893	174939	199291	193041	15925
	propanal	135616	98490	113924	116010	18651
	butanal	29589	23793	27831	27071	2972
	hexanal	5842	9578	10464	8628	2453
200 µL	formaldehyde	97832	118925	94550	103769	13228
	acetonitrile	80746	87464	81396	83202	3705
	propanal	45895	49646	48720	48087	1954
	butanal	10685	16932	14671	14096	3163
	hexanal	3872	4274	4118	4088	203
300 µL	formaldehyde	56929	51793	55897	54873	2717
	acetonitrile	34674	30463	34265	33134	2322
	propanal	15783	20467	20336	18862	2667
	butanal	5865	6359	6352	6192	283
	hexanal	2964	4067	4636	3889	850

Table A-11 Peak area of aldehydes-DNPH-derivatives with various extraction rates by using nylon6 as the sorbent.

Extraction rates (mL/min)	Reagents	Peak Area			mean	SD
		Trial 1	Trial 2	Trial 3		
0.33	formaldehyde	475252	427825	451384	451487	23714
	acetonitrile	308421	257342	283972	283245	25547
	propanal	228302	198776	204611	210563	15637
	butanal	68250	72429	72147	70942	2336
	hexanal	29793	35782	33095	32890	3000
0.50	formaldehyde	401732	452145	487756	447211	43224
	acetonitrile	258563	308676	289747	285662	25305
	propanal	197544	235562	203299	212135	20491
	butanal	68435	72452	70505	70464	2009
	hexanal	29743	32643	33335	31907	1906
1.00	formaldehyde	427653	483480	461643	457592	28133
	acetonitrile	307058	270846	299335	292413	19073
	propanal	194637	227059	221309	214335	17300
	butanal	68980	72773	76602	72785	3811
	hexanal	35713	30793	34345	33617	2540
2.00	formaldehyde	249794	317932	316635	294787	38970
	acetonitrile	163723	180241	191674	178546	14052
	propanal	150891	161384	164260	158845	7037
	butanal	55423	61385	58590	58466	2983
	hexanal	20782	25421	25050	23751	2578

Table A-12 Peak area of aldehydes-DNPH-derivatives with various extraction rates by using PS as the sorbent.

Extraction rates (mL/min)	Reagents	Peak Area			mean	SD
		Trial 1	Trial 2	Trial 3		
0.33	formaldehyde	358824	402582	384729	382045	22002
	acetonitrile	218853	268294	209819	232322	31478
	propanal	104782	138474	121427	121561	16846
	butanal	48260	53785	52224	51423	2848
	hexanal	17432	24462	19474	20456	3616
0.50	formaldehyde	385205	359254	389928	378129	16516
	acetonitrile	248927	204382	229593	227634	22337
	propanal	147932	105356	101333	118207	25821
	butanal	53785	48279	48374	50146	3152
	hexanal	21583	17436	19427	19482	2074
1.00	formaldehyde	402396	364201	391106	385901	19622
	acetonitrile	256844	217940	220145	231643	21853
	propanal	146936	105794	110255	120995	22576
	butanal	48647	54211	49158	50672	3075
	hexanal	18974	21693	25243	21970	3144
2.00	formaldehyde	228943	274939	241303	248395	23804
	acetonitrile	124894	174324	179708	159642	30213
	propanal	99753	127437	98103	108431	16480
	butanal	41775	48726	46818	45773	3591
	hexanal	9735	13795	10196	11242	2223

Table A-13 Peak area of aldehydes-DNPH-derivatives with various extraction rates by using PAN as the sorbent.

Extraction rates (mL/min)	Reagents	Peak Area			mean	SD
		Trial 1	Trial 2	Trial 3		
0.33	formaldehyde	305285	268352	274202	282613	19851
	acetonitrile	248371	179525	172881	200259	41798
	propanal	146362	98525	98136	114341	27732
	butanal	28542	21654	30519	26905	4654
	hexanal	8365	6843	8561	7923	940
0.50	formaldehyde	317936	279524	273779	290413	24008
	acetonitrile	228052	187255	170377	195228	29653
	propanal	138725	108452	103958	117045	18909
	butanal	29041	24857	27219	27039	2098
	hexanal	7962	6845	7660	7489	578
1.00	formaldehyde	249584	294738	317302	287208	34481
	acetonitrile	204893	174939	199291	193041	15925
	propanal	135616	98490	113924	116010	18651
	butanal	29589	23793	27831	27071	2972
	hexanal	7842	9578	8464	8628	880
2.00	formaldehyde	174583	218360	164847	185930	28504
	acetonitrile	97532	119552	90806	102630	15036
	propanal	86359	91775	90558	89564	2842
	butanal	14086	18435	18155	16892	2434
	hexanal	5927	6829	6711	6489	490

VITA

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Poster presentation and proceeding

"DNPH-coated electrospun fibrous Nylon6 membrane for determination of aldehydes in water" Rungthip Manakit, Puttaruksa Varanusupakul. Poster presentation and proceeding, Pure and Applied Chemistry International Conference 2014 (PACCON 2014), The Centara Hotel and Convention Centre, Khon Kaen, Thailand, 8-10 January, 2014.