CHAPTER 5

RESULTS

In this chapter , the experimental data obtained are presented and compared with data obtained from the literature .

5.1 Experimental data and results presentation

The presentation of the data and results obtained in this study is sequenced as follows :

1. Characteristics of system studied .
2. Typical experimental data and results .
3. Graphical descriptions of the results .

5.1.1 Characteristics of systems studied

The eight systems studied are designated by the letters A to H and table 5.1 summarizes the characteristics of each . For instance , system A-2-0.4 refers to the set of experiments with a 2/8 in OD column (0.216 in ID) filled with molecular sieve carbon 3 A with an average 0.4919 mm diameter .

5.1.2 Typical experimental data and results

Table 5.2 lists the volumetric flow rates , velocities , Reynolds numbers , Peclet numbers and the measured dispersion coefficients for each run . A sample calculation for system H-4-0.9 with a volumetric flow rate 0.81 cc/sec is given in appendix G .

Table 5.1 Characteristics of Experimental Systems

SYSTEM	SYMBOL	MSC-3 A (mm)	TUBE O.D. (inch)	TUBE I.D. (inch)	L (cm)	d_t/d_p	ϵ	PACKING WEIGHT (g)
A-2-0.4	•	0.4919	2/8	0.216	60	11.15	0.48	5.9212
B-3-0.4	▲	0.4919	3/8	0.341	60	17.61	0.51	18.3239
C-3-0.6	□	0.6314	3/8	0.341	60	13.72	0.52	18.5792
D-3-0.8	▽	0.8075	3/8	0.341	60	10.73	0.52	18.6231
E-4-0.4	0	0.4919	4/8	0.450	60	23.24	0.51	27.9334
F-4-0.6	◍	0.6314	4/8	0.450	60	18.1	0.52	28.9503
G-4-0.8	▧	0.8075	4/8	0.450	60	14.15	0.53	28.5382
H-4-0.9	×	0.9861	4/8	0.450	60	11.59	0.53	27.8913

Table 5.2 Results obtained

system	Q (cc/sec)	v (cm/s)	Re	Pe	Ez (cm /s)
A-0.2	0.15	0.6314	0.6002	0.4304	0.0721
	0.25	1.0523	1.0003	0.4076	0.1270
	0.40	1.6836	1.6005	0.3345	0.2476
	0.50	2.1045	2.0006	0.3263	0.3173
	0.81	3.409	3.2407	0.1058	1.5856
B-3-0.4	0.20	0.3364	0.3198	0.4596	0.0360
	0.33	0.5551	0.5277	0.3862	0.0707
	0.56	0.9420	0.8955	0.3795	0.1221
	0.91	1.5308	1.4552	0.3041	0.2476
	1.12	1.8840	1.7910	0.2934	0.3158
C-3-0.6	0.20	0.3364	0.4105	0.5045	0.0421
	0.26	0.4374	0.5337	0.5003	0.0552
	0.44	0.7402	0.9032	0.4828	0.0968
	0.71	1.1943	1.4573	0.4410	0.1710
	0.87	1.4635	1.7858	0.3747	0.2466
D-3-0.8	0.34	0.519	0.8925	0.6326	0.0730
	0.55	0.9252	1.4438	0.6139	0.1217
	0.68	1.1439	1.7851	0.4846	0.1906
E-4-0.4	0.20	0.1959	0.1862	0.1287	0.0749
	0.30	0.2939	0.2794	0.1205	0.1200
	0.46	0.4507	0.4284	0.0804	0.2759
	0.81	0.7936	0.7544	0.0651	0.7558
	0.99	0.9699	0.9220	0.0394	1.2124
F-4-0.6	0.20	0.1959	0.2390	0.2917	0.0424
	0.30	0.2939	0.3586	0.2904	0.0639
	0.50	0.4899	0.5978	0.2578	0.1200
	0.78	0.7642	0.9325	0.2399	0.2011
	1.54	1.5088	1.8411	0.0947	1.0059
	1.99	1.9496	2.3789	0.0442	2.7851
G-4-0.8	0.20	0.1959	0.3057	0.3812	0.0415
	0.29	0.2891	0.4434	0.3607	0.0636
	0.60	0.5878	0.9173	0.3135	0.1514
	0.81	0.7936	1.2384	0.2544	0.2519
	1.21	1.1854	1.8499	0.1521	0.6294
H-4-0.9	0.20	0.1959	0.3733	0.4274	0.0452
	0.30	0.2939	0.5601	0.4243	0.0683
	0.50	0.4899	0.9336	0.3780	0.1278
	0.81	0.7936	1.5124	0.3419	0.2289
	0.99	0.9648	1.8483	0.3271	0.2924

5.1.3 Graphical representations of the results

A complete graphical illustration of E_z (cm^2/s) versus Re for an 4/8 in OD column with variations in particle sizes is shown in figure 5.1 .This case can also be plotted using a relationship between Pe and Re as given in figure 5.2 .

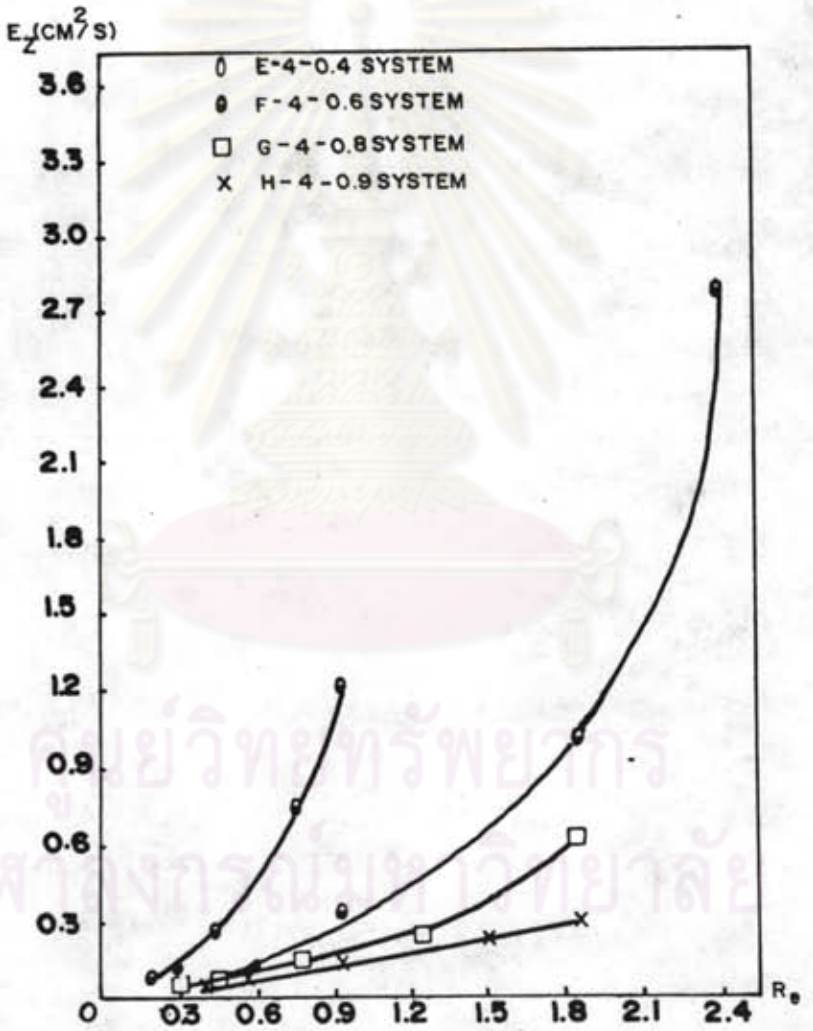

Fig. 5.1 Effect of particle size on dispersion in a 4/8 inch diameter column .

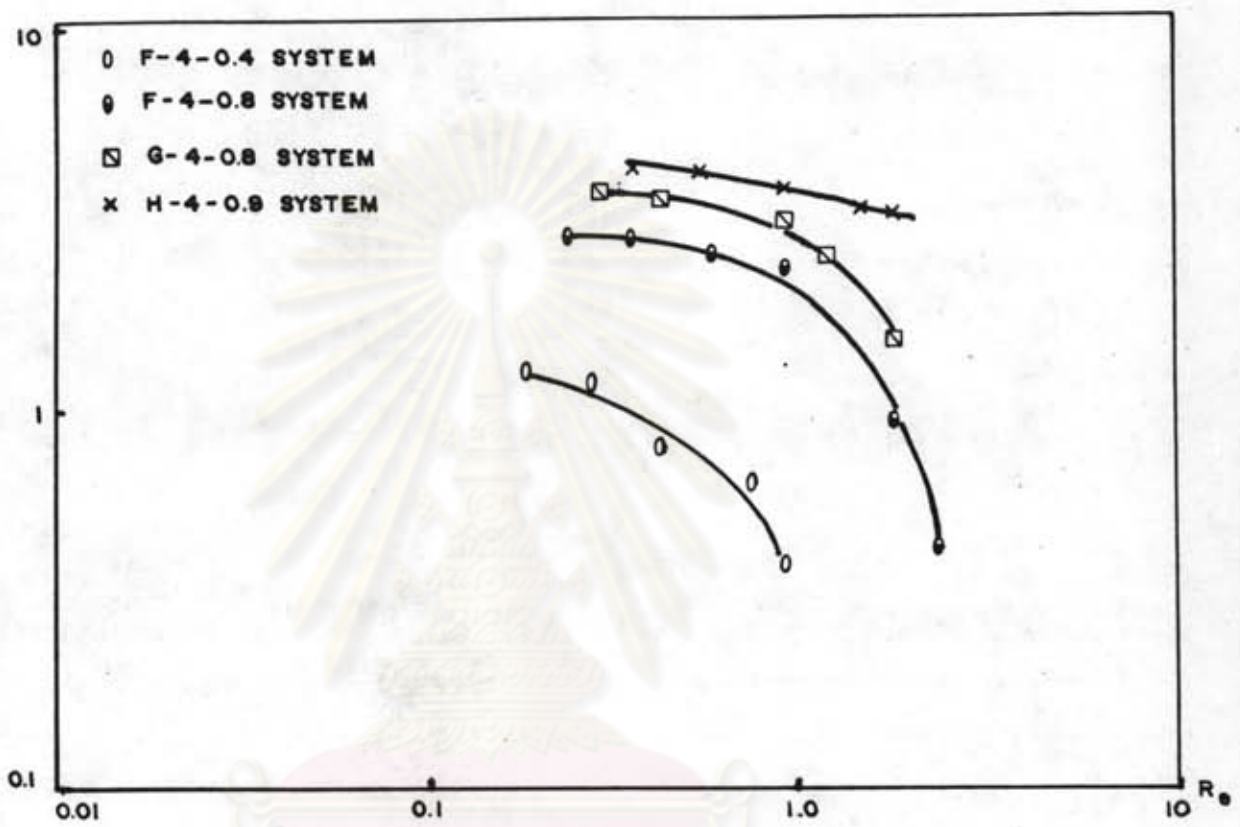

Fig. 5.2 Peclet numbers vs Reynolds numbers showing effect of particle size in 4/8 inch column .

Similarly , figure 5.3 illustrates the plots of E_z (cm^2/s) against Re for an 3/8 in OD column . The same case can be presented in figure 5.4 by plotting Pe versus Re . To demonstrate such effect of particle size diameter upon axial dispersion , the plots of E_z (cm^2/s) against d_p are also presented in figure 5.5 .

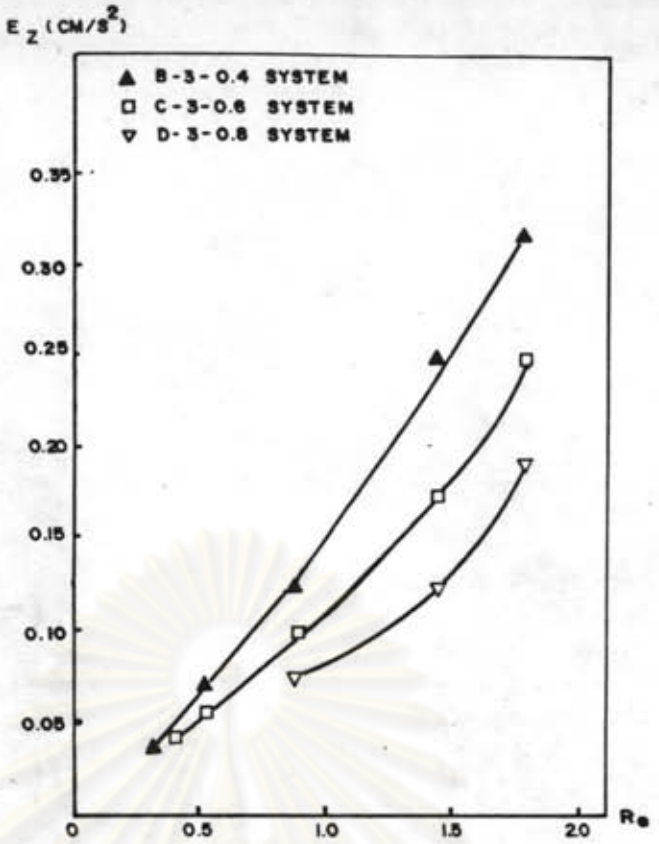

Fig. 5.3 Effect of particle size on dispersion in a 3/8 inch diameter column .

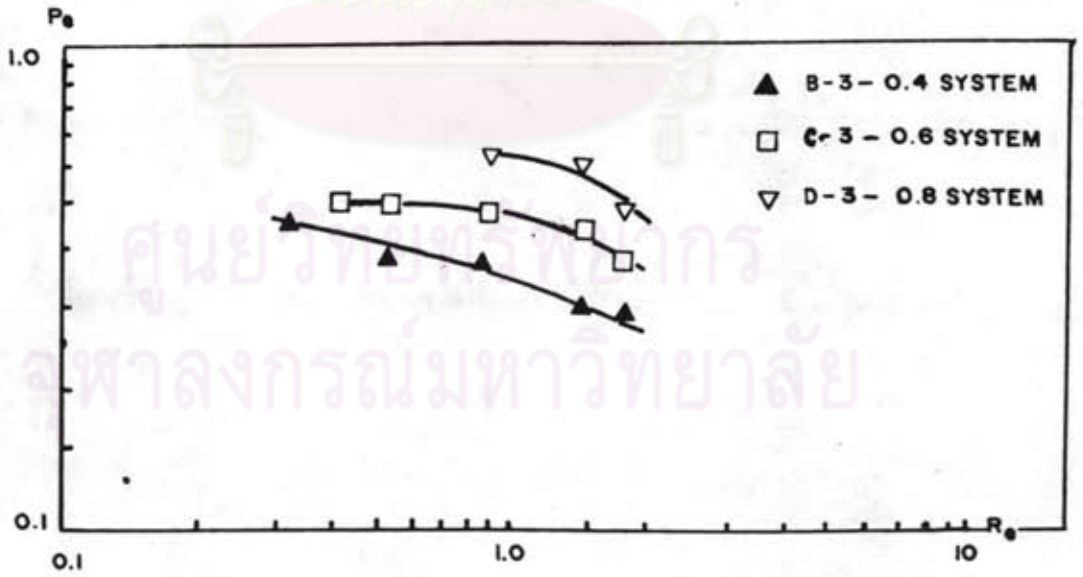

Fig. 5.4 Peclet numbers vs Reynolds numbers as a function of particle size in 3/8 inch column .

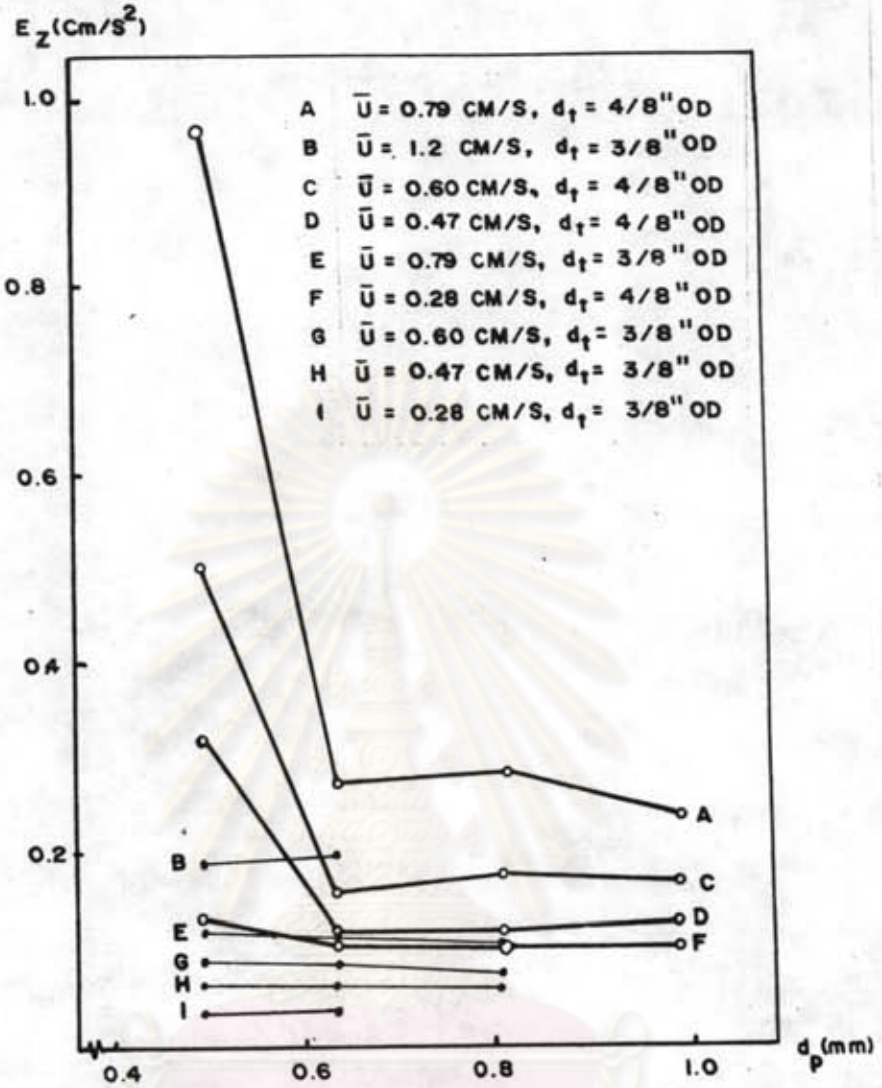

Fig. 5.5 Effect of particle size on dispersion in a 3/8 inch diameter column and a 4/8 inch diameter column .

Figures 5.6 , 5.7 and 5.8 show the effect of tube diameter variations with fixed particle size of 0.4919 mm ; the first shows a relationship between E_z (cm^2/s) and Re , the second shows the plots of Pe versus Re , the last illustrates E_z (cm^2/s) versus u (cm/s) .

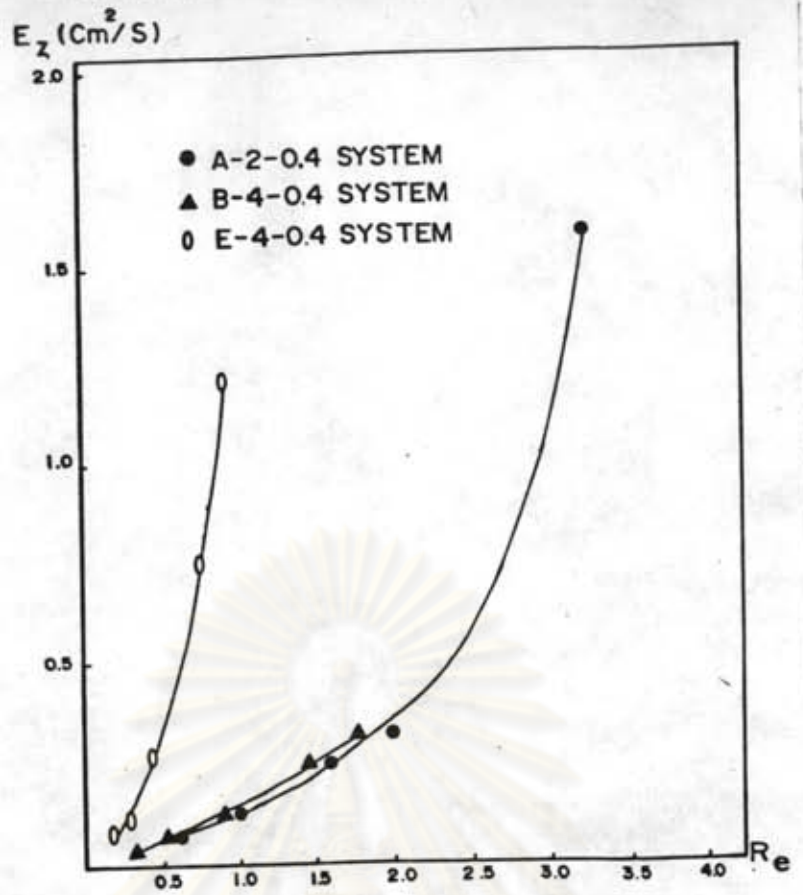

Fig. 5.6 Effect of column diameter on dispersion in columns packed with 0.4919 mm particles .

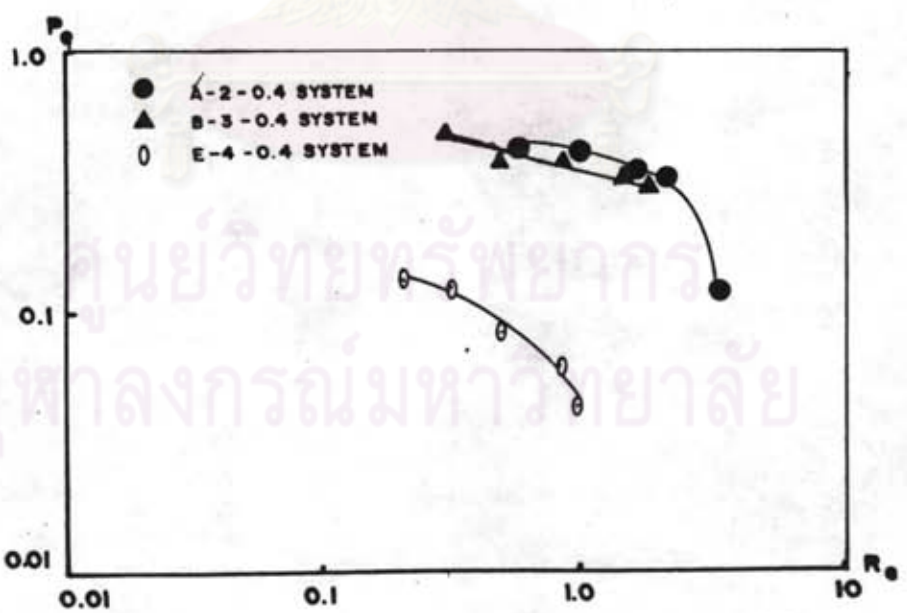

Fig. 5.7 Peclet numbers vs Reynolds numbers showing effect of column diameter on dispersion for bed packed with 0.4919 mm particles .

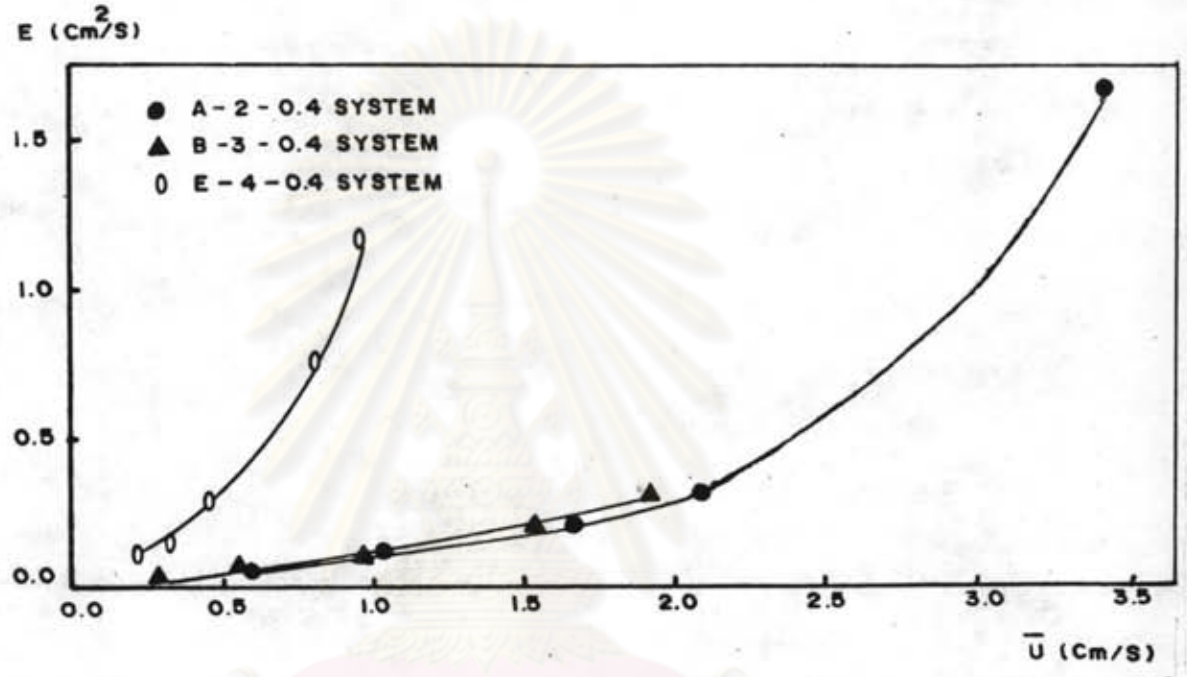

Fig. 5.8 Axial dispersion vs velocity showing effect of column diameter on dispersion for bed packed with 0.4919 mm particles .

Similarly , figure 5.9 and 5.10 show such effects ; the former for particle size fixed at 0.6314 mm , the later for a given particle size 0.8075 mm . Figure 5.11 shows all eight systems plotting in E_z (cm^2/s) versus u (cm/s) .

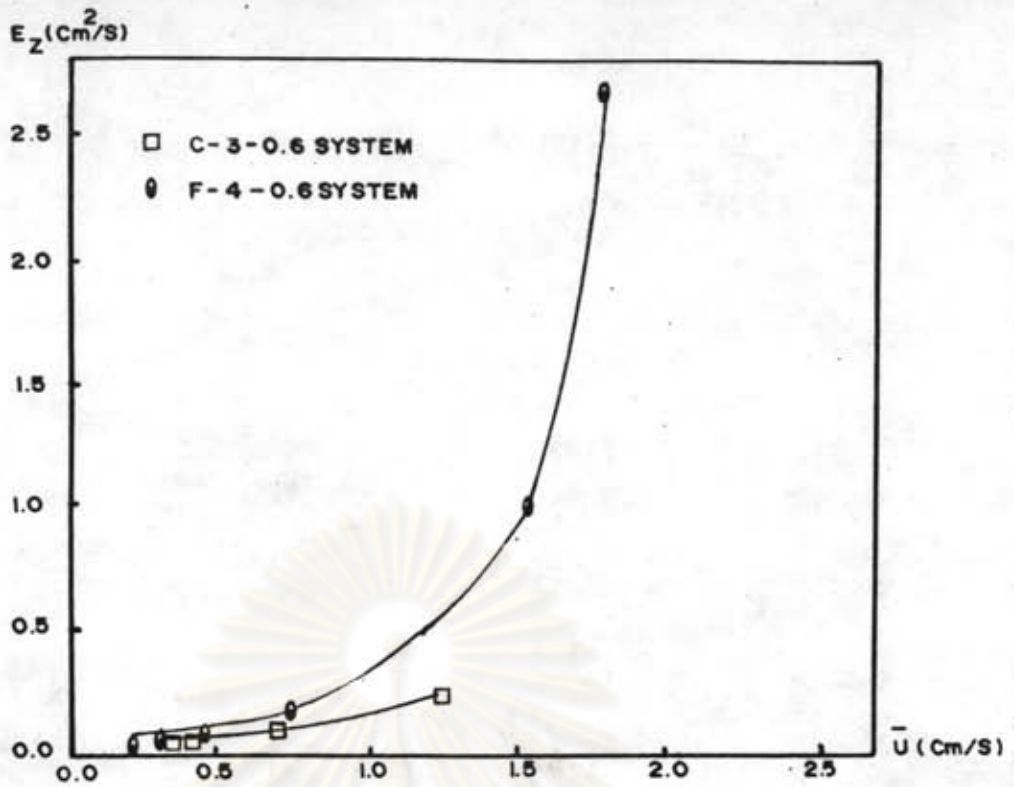

Fig. 5.9 Axial dispersion vs velocity showing effect of column diameter on dispersion for bed packed with 0.6314 mm particles .

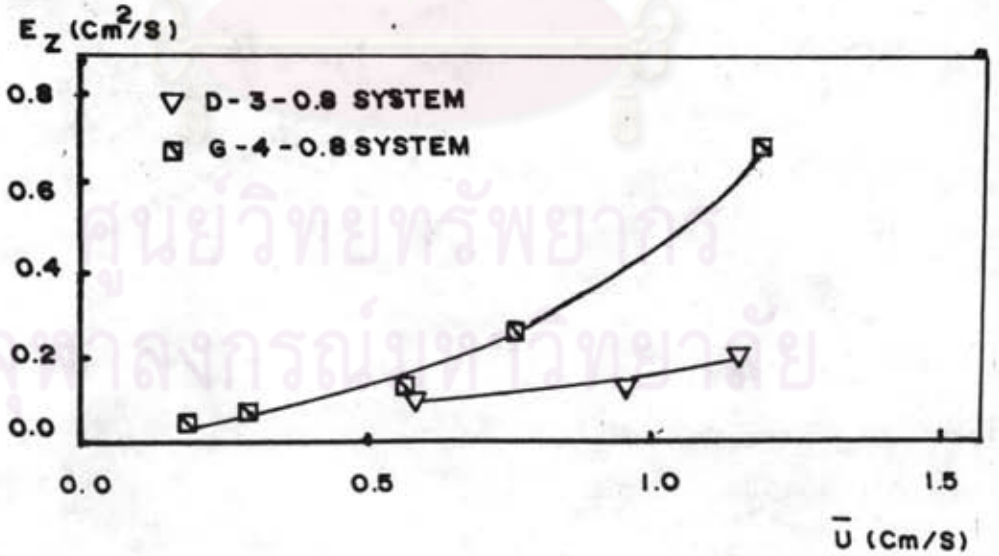

Fig. 5.10 Axial dispersion vs velocity showing effect of column diameter on dispersion for bed packed with 0.8075 mm particles .

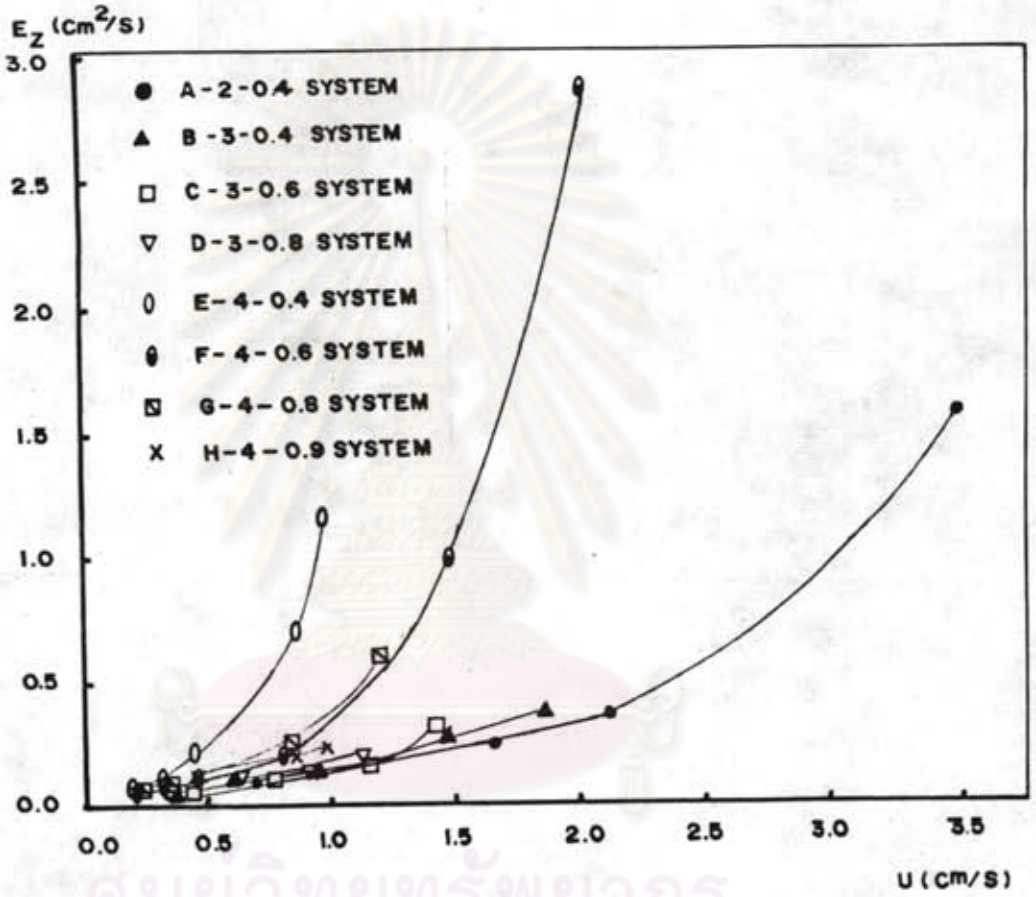

Fig. 5.11 Effect of velocity on dispersion for entire set of data .

The experimental parameters (Pe , γ) obtained from moment's method are checked by comparing experimental curves with theoretical concentration - time profiles . Comparisons for a few typical runs are reproduced in appendix D .

5.2 Comparison of results of this work and others

In order to compare this work with those obtained from previous investigators , the relationship between Pe and Re is plotted in a logarithmic scale as shown in figure 5.12 . The ordinated Peclet number is based on superficial velocity , particle size diameter and axial dispersion coefficient ($Pe = ud_p/E_z$) . The Reynolds number is defined by a superficial velocity , a particle size diameter , density and viscosity of gases used ($Re = ud_p\rho/\mu$) .

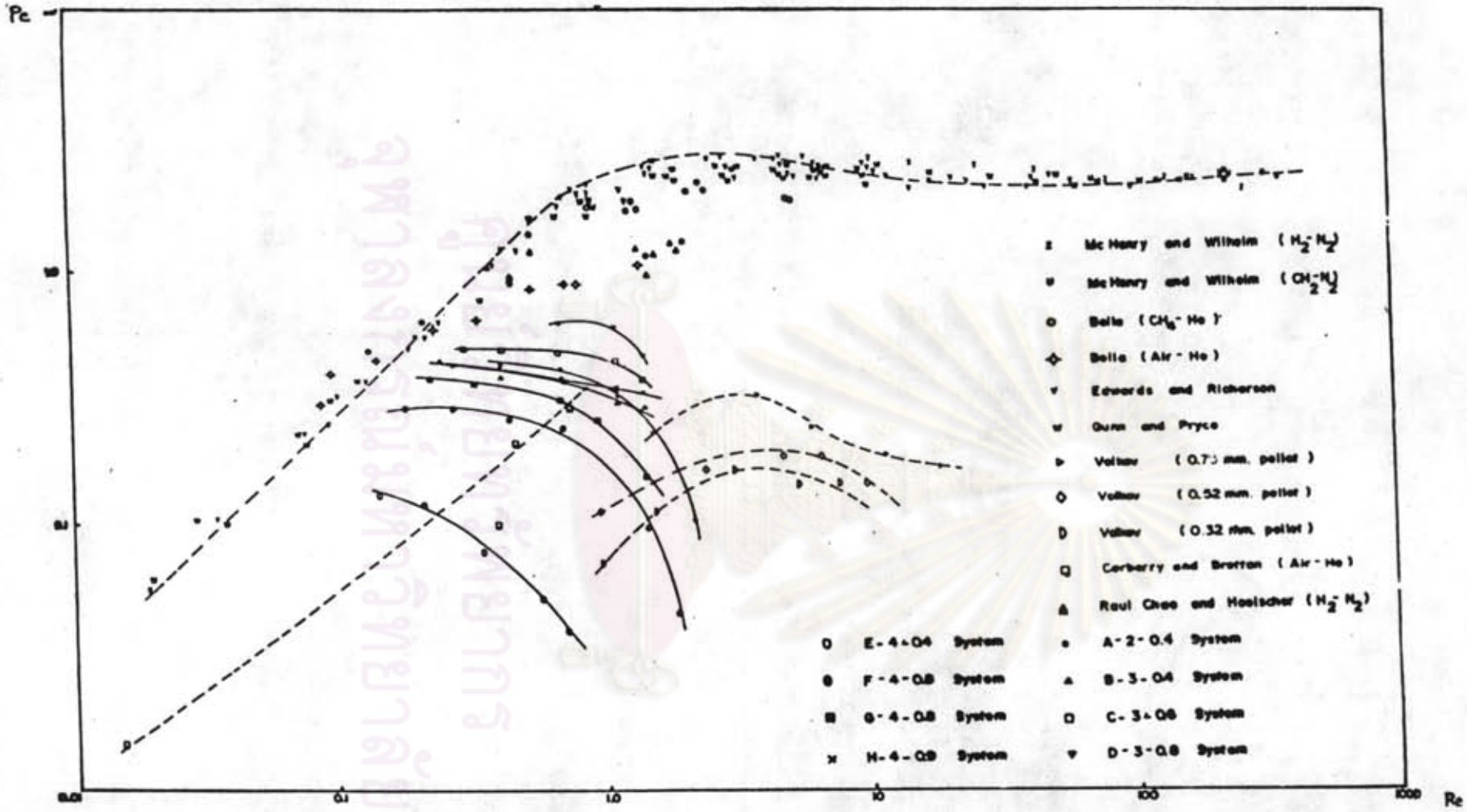

Fig. 5.12 Comparison of results obtained from the literatures and this work showing variations of Peclet numbers with Reynolds numbers for flow of gases through packed beds