รายการอ้างอิง

1. American Society for Testing and Materials Standard Test Method for Compressive Properties of Rigid Plastics (metrix); ASTMD695M, 1991.
2. American Society for Testing and Materials Standard Test Method for Resistance of Plastics to Chemical Reagents; ASTMB543, 1987.
3. American Society for Testing and Materials Standard Practice for Preparation of Compression-Molded Polyethylene Test Sheet and Test Specimens; ASTMD1928, 1990.
4. American National Standards Institute/American Nuclear Society, American National Standard for Measurment of Leachability of Solidified low-level Radioactive wastes by a short-term Test Procedure; ANSI/ANS16.1-1986.
5. Andrew Holmes-Siedle and Len Adams, "Handbook of Radiation effects" Oxford university Press, Oxford, 1993.
6. Anon. "Stretch Silane crosslinkes Plastic Products" *Res. Discl.* , 1988, vol 290, p366.
7. Anon. "Silane crosslinked Products with increased strength" *Res. Discl.* , 1988, vol 290, p371.
8. Anon. "Silane crosslinked plastic products resistant to environmental stress cracking, chemical and solution" *Res. Discl.* , 1988, vol 290, p383.
9. Auther H. Brownlow, "Geochemistry" Prentice-Hall, Inc., Eaglewood Cliffs, New Jersey, 1979.
10. Bolt G. H. and Bruggenwert M. G. M. , "Soil Chemistry, A Basic Element " Elsevier Scientific Publishing company, New York, 1976.
11. Franz E.M. and Colombo P., "Development and evaluation of Polyethylene as solidifying agent for low level waste", International meeting on low, intermediate and high level waste management and decommissioning, New York, USA, 14-18 Sep., 1986, 11 p.
12. Franz E.M.,Heiser L.H.and Colombo P., "Solidification of commercial and defense low level radioactive waste in Polyethylene", 9th annual low-level radioactive waste management program conference, Denver, USA, 25-27 Aug., 1987, 16 p.
13. Franz E.M.,Heiser L.H.and Colombo P.,"A Process for solidifying sodium nitrate waste in Polyethylene", 4th International hazardous waste symposium on environment aspect of stabilization solidification of hazardous and radioactive waste, Atlanta, USA, 3-6 May.; 1987, 23 p.

14. Fred W. Billmeyer, Jr., "Text book of Polymer Science", 2nd ed., John wiley&sons, New York, 1971.

15. George Arnold and the other"Polyethylene Solidification Of Low-Level Wastes",Topical Report,1984.

16. Gachter R. and Muller H. "Plastics Additive Handbook", 4th.ed., Hanser Publishers, 1993.

17. Harry S. Katz and John V. Milewski, "Handbook of Filler for Plastics",V.2, 2nd.ed., Van Nostrand Reinhold, 1987.

18. Herman F. Mark and Norman G. Gaylord, "Encyclopedia of Polymer Science and Technology", V.12, Interscience Publishers, New York, 1970.

19. Herman S. Kaufman and Joseph J. Falcetta, " Introduction to polymer Science and Technology", John wiley&sons,1977.

20. Hayase Y.,Moriyama N.,Hayashi M.and Kurita M.,"Solidification of radioactive waste using thermoplastic resin",IAEA Proceeding of a symposium, Conditioning of radioactive waste for storage and disposal, Utrecht, 21-25 June, 1982.

21. IAEA Technical report series no.222, "Conditioning of low and intermediate level radioactive wastes", Vienna,1988.

22. IAEA Technical report series no.289, "Immobilization of low and intermediate level radioactive wastes", Vienna,1988.

23. IAEA Yearbook 1995 "Nuclear power, Nuclear Fuel Cycle and Waste Management : Status and Trend.

24. Kosfeld R., Uhlenbroich Th., and Maurer F. H. J. "Dynamic Mechanical Investigations of Highly Filled Polyethylene" Polymer Additives, Physical Chemistry, Duisburg University.

25. Neilson, R.M., Jr., and P. Colombo, "Waste Form Developement program Annual Progress Report", BNL-51614, Brookhaven National Laboratory, Upton, NY, 1982.

26. Nuclear Regulatory Commission / United State Nuclear Regulartory Commission, Avilibility of revised Staff Technical Position on Waste form, 1991.

27. Nuntawan Y., "Treatment of low level radioactive Cs-137 and Tc-99 liquid waste by inorganic ion-exchange", Thesis, Chulalonngkorn University, 1992.

28. Patton J. , "Materials in Industry", 2nd ed., Prentice-Hall inc., Engle wood cliffs, New Jersey, 1976.

29. Paul D., John H, III, and Peter Colombo, "Polyethylene Encapsulation of Nitrate Salt Waste : Waste Form Stability, Process Scale-Up, and Economics",Technology Status Topical Report,1991.

30. R.J.Crawford,"Plastics engineering", 2nd ed., Pergamon Press, 1989.

31. Robert E. Berline and Catherine C. Stanton, "Radioactive waste management", John wiley & sons,1989.

32. Robert V. Hogg and Elliot A. Tanis, "Probability & Statistical Inference",Macmillan Publishing co., inc., New York, 1977.

33. Robert J.Young, "Introduction to polymers", Cambridge, London, 1983.

34. Stearn Vonglertmongkol, "Inventory and Management of Radioactive waste in Thailand", Thesis, Chulalonngkorn University, 1994

35. Thomas H. Cortney, "Mechanical Behavior of Materials", McGraw-Hill, Inc., 1990.

36. Triglio,G.,"Volume Reduction Techniques in Low-Level Radioactive Waste Management", prepared for Division of Waste Management, USNRC by Teknekron, Inc.,Berkley, CA, September 1981.

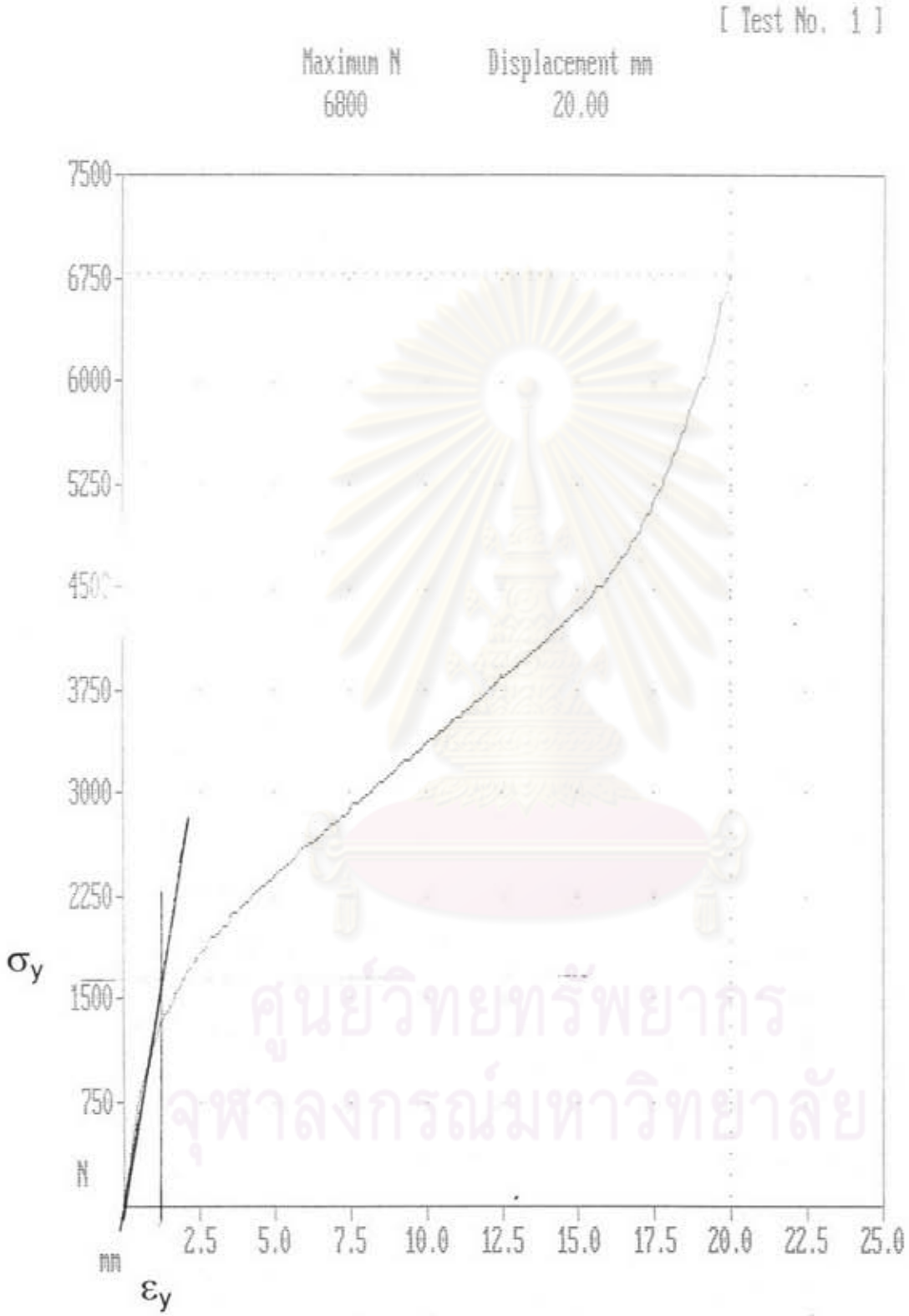
37. William C. Wake, "Filler for Plastics", Iliffe Books,London,1971.

38. Zhou, H., and P.Colombo, "Solidification of Radioactive Waste in Mesonry Cement", Paper presented at the 1984 Fall Convention Of the American Concrete Institute, NY,10/28-11/2, 1984

39. Zikovsky Lubomir, Dr., and Thai-Canadian Nuclear Human Resources Development Linkage Project,"Radioactive Waste Management Workbook", 1997.

ภาคผนวก

Product Code : 50%NA2SO
Batch Reference : 5



รูป ผ.1แสดงค่าที่ใช้ในการคำนวณความทนทานต่อแรงกดที่จุดคราก

ตาราง ผ.1 ข้อมูลดิบของผลการทดสอบความทนทานต่อแรงกดของ waste forms ที่ yield point

	initial state		yield state				student's t error	
Sample	diameter	Height,	displacemen	Load	eng.strength	strain	eng.strength	strain
	mm	mm	(mm)	N	psi	%	psi	%
10%ash	16.47	28.72	1.02	840.90	572.32	3.55		
	16.47	28.72	1.02	840.90	572.32	3.55		
	16.61	27.80	1.46	1345.50	900.73	5.24		
	16.76	27.34	1.29	1345.50	884.33	4.73		
Average value					732.42	4.27	217.65	1.01
30%ash	16.51	32.90	1.19	1121.20	759.39	3.61		
	16.51	32.66	1.20	1096.96	742.68	3.67		
	16.49	31.41	1.46	1431.80	972.12	4.64		
	16.70	30.30	1.50	1468.18	971.52	4.95		
Average value					861.43	4.22	150.18	0.80
50%ash	16.68	34.68	1.15	2045.50	1356.79	3.32		
	16.64	33.16	1.21	2181.80	1454.74	3.64		
	16.67	32.09	1.15	2303.03	1529.44	3.57		
	16.59	31.28	1.35	2295.50	1540.41	4.33		
Average value					1470.35	3.71	99.69	0.51
10%sludge	16.72	28.15	1.50	824.24	544.11	5.33		
	16.95	27.75	0.88	606.10	389.48	3.15		
	16.78	26.66	1.15	787.90	516.61	4.30		
	16.67	25.11	1.33	1103.03	732.81	5.30		
Average value					545.75	4.52	166.75	1.21
30%sludge	16.37	34.90	1.31	715.15	492.49	3.76		
	16.55	28.80	1.67	651.50	439.31	5.80		
	16.32	28.38	1.15	636.36	441.10	4.04		
	16.20	26.24	1.27	636.36	447.66	4.84		
Average value					455.14	4.61	29.60	1.08
50%sludge	16.67	30.88	1.17	1663.60	1105.24	3.78		
	16.61	30.70	1.35	1663.60	1113.24	4.41		
	16.61	30.06	1.40	2230.30	1493.06	4.64		
	16.61	29.64	2.03	2659.10	1778.69	6.85		
Average value					1372.55	4.92	383.14	1.57
10%resin	16.59	31.57	3.20	1075.75	721.89	10.14		
	16.27	31.03	3.12	1590.00	1109.37	10.06		
	16.55	29.37	2.67	1621.20	1093.19	9.09		
Average value					1074.25	8.55	314.76	2.90
30%resin	17.06	34.90	2.08	524.24	332.41	5.97		
	17.05	34.51	1.90	660.60	419.37	5.49		
	17.00	33.78	2.04	745.45	476.21	6.04		
	16.94	30.14	1.88	775.75	499.28	6.22		
Average value					431.82	5.93	87.40	0.37
50%resin	17.48	34.01	2.29	455.45	275.19	6.73		
	17.38	33.55	2.19	509.10	311.04	6.52		
	17.30	32.67	2.50	506.36	312.23	7.65		
Average value					299.49	6.97	80.43	0.84

ข้อมูลดิบของผลการทดสอบความทนทานต่อแรงกดของ waste forms ที่ yield point (ต่อ)

	initial state		yield state				student's t error	
Sample	diameter	Height,	displacemen	Load	eng.strength	strain	eng.strength	strain
	mm	mm	(mm)	N	psi	%	psi	%
10%boric	16.72	33.92	1.25	1204.50	795.77	3.69		
	16.77	33.83	1.25	1295.45	850.76	3.69		
	16.69	33.48	1.35	1304.50	864.24	4.04		
	16.91	32.67	1.40	1286.36	830.53	4.27		
Average value					835.32	3.92	35.05	0.34
	16.86	34.51	1.15	1718.00	1116.24	3.32		
30%boric	16.84	33.27	1.25	1709.10	1112.66	3.76		
	16.83	32.69	1.25	1742.40	1136.13	3.82		
	16.81	30.69	1.15	1627.27	1063.17	3.73		
Average value					1107.05	3.66	36.50	0.27
50%boric	16.62	34.14	1.50	1558.78	1041.84	4.39		
	16.63	33.91	1.67	1534.50	1024.38	4.92		
	16.62	33.49	1.32	1376.97	919.95	3.94		
	16.68	33.04	1.58	1681.80	1115.54	4.78		
Average value					1025.43	4.51	94.89	0.52
10% Na_2SO_4	16.28	32.25	1.92	1621.21	1129.76	5.95		
	16.50	31.46	1.33	1545.45	1048.43	4.23		
	16.54	30.91	1.67	1659.10	1119.64	5.40		
	16.33	31.05	1.80	1590.90	1100.96	5.80		
Average value					1099.70	5.35	42.59	0.92
30%Na_2SO_4	16.38	32.47	1.77	1757.57	1208.89	5.45		
	16.37	32.42	1.67	1727.27	1189.98	5.15		
	16.35	31.05	1.72	1750.00	1208.59	5.53		
	16.38	32.57	1.67	1745.45	1201.04	5.13		
Average value					1202.13	5.31	10.44	0.24
50%Na_2SO_4	16.58	31.85	1.50	1909.09	1281.62	4.71		
	16.60	31.76	1.57	1818.18	1218.14	4.93		
	16.56	31.98	1.67	1909.09	1285.24	5.22		
	16.61	31.23	1.50	1727.27	1155.84	4.80		
Average value					1235.21	4.92	72.04	0.26
Blank	16.42	40.51	3.23	1590.90	1089.37	7.97		
	16.55	39.44	2.71	1454.50	980.78	6.87		
	16.39	39.63	2.71	1560.60	1072.54	6.83		
	16.60	38.27	2.40	1500.00	1004.97	6.26		
Average value					1036.91	6.98	61.48	0.84

* The error in table were calculated from t-distrbution with confidence interval of 95%[32]

$T=(\text{means-random interval})/(\text{gaussian standard deviation}/(\text{no of interval-1})^{(1/2)})$

$P(T<=t_0)$=confidence interval which can be found in next page

$[\text{means} \pm t_0 X (\text{gaussian standard deviation}/(\text{no of interval-1})^{(1/2)}]$

$\text{error}= \pm t_0 X (\text{gaussian standard deviation}/(\text{no of interval-1})^{(1/2)}$ which values are given in table

Product Code : 50%naso4
Batch Reference : 11

[Test No. 3]

10.0%	15.0%	20.0%	25%	30%	Ts	N	Eb%
108.8	112.8	113	-	-	113.0		24.58

รูป ผ.2 แสดงค่าที่ใช้ในการคำนวณความต้านทานแรงดึงที่จุดครากและจุดขาด

ตาราง ผ.2ข้อมูลดิบของผลการทดสอบความต้านทานแรงดึงของ waste form ชนิดต่าง ๆ

Sample	Average Thickness	Maximum point					Yield point				
		Load	strength	strain	Student't error		Load	strength	strain	Student't error	
	mm	N	Psi	%	strength	strain	N	Psi	%	strength	strain
	2.74	154	1358.27	28.30			124.2	1095.81	3.38		
10%Ash	2.68	152	1370.65	29.00			115.2	1038.37	3.38		
	2.74	164	1444.71	22.90			127.3	1121.18	3.75		
	2.76	157	1374.70	26.90			121.2	1061.34	3.88		
	2.74	163	1439.40	31.30			115.2	1016.87	3.75		
Average value			1397.55	27.68	39.21	2.97	120.6	1066.71	3.63	40.25	0.22
	2.61	160	1483.38	16.30			124.2	1151.86	2.63		
30%ash	2.63	165	1516.16	15.35			131.8	1211.26	3.00		
	2.68	167	1504.04	14.85			130.3	1173.54	2.75		
	2.67	163	1475.34	17.05			121.2	1097.11	2.38		
	2.68	165	1489.73	20.15			122.7	1108.06	3.25		
Average value			1493.73	15.89	15.60	1.99	126.1	1148.37	2.80	44.85	0.32
	2.49	174	1691.02	9.08			139.4	1354.70	2.50		
50%ash	2.52	179	1716.60	8.75			142.4	1365.84	2.71		
	2.54	184	1750.66	9.75			151.5	1441.58	2.29		
	2.47	171	1673.08	9.50			145.5	1423.14	2.71		
	2.57	177	1666.56	8.92			136.4	1283.94	2.08		
Average value			1699.58	9.20	32.91	0.40	143	1373.84	2.46	59.41	0.26
	2.58	131.5	1233.34	12.25			109.1	1023.17	2.50		
10%sludge	2.68	139	1253.42	9.42			110.6	997.38	2.08		
	2.54	141	1341.54	15.25			115.2	1095.60	3.75		
	2.53	145	1383.22	11.25			115.2	1098.48	2.71		
	2.53	142	1358.18	10.92			98.48	941.97	2.92		
Average value			1313.94	12.04	63.38	2.07	109.7	1031.32	2.79	63.68	0.59
	2.44	154	1523.19	44.90			95.45	944.13	2.71		
30%sludge	2.49	156	1514.06	65.50			100	970.55	2.71		
	2.47	154.5	1509.60	51.40			107.6	1051.11	3.75		
	2.49	157	1523.76	50.60			121.2	1176.42	4.17		
	2.48	152	1481.18	28.60			110.6	1077.81	3.13		
Average value			1510.36	48.20	16.58	12.71	107	1044.00	3.29	88.03	0.62
	2.60	151	1405.33	7.65			125.8	1170.40	2.38		
50%sludge	2.55	140	1325.07	5.30			121.2	1147.24	1.75		
	2.55	145.5	1380.73	7.65			112.1	1063.98	2.38		
	2.51	151	1455.78	6.80			115.2	1110.17	1.88		
	2.58	148	1386.30	6.50			116.7	1092.81	1.88		
Average value			1390.64	6.85	44.92	0.93	118.2	1116.92	2.05	40.48	0.29
	2.75	144	1265.45	23.10			110.6	971.99	4.08		
10%resin	2.71	153	1364.39	32.40			98.48	878.25	3.83		
	2.78	150.5	1306.74	19.00			101.5	881.42	3.50		
	2.67	150	1355.99	30.20			98.48	890.29	2.83		
	2.57	149	1399.29	20.90			106.1	996.04	3.58		
Average value			1338.37	26.18	50.04	5.60	103	923.60	3.57	53.37	0.45
	2.56	118.5	1117.20	14.53			87.88	828.51	2.50		
30%resin	2.52	101	969.87	9.53			95.45	916.62	3.00		
	2.42	113	1130.00	12.97			84.85	848.48	2.17		
	2.49	122	1182.49	21.13			69.7	675.54	3.00		
	2.40	117	1178.13	13.27			87.88	884.89	2.83		
Average value			1115.54	14.54	82.34	4.05	85.15	830.81	2.70	88.82	0.34

ข้อมูลดิบของผลการทดสอบความต้านทานแรงดึงของ waste form ชนิดต่าง ๆ(ต่อ)

Sample	Average Thickness	Maximum point					Yield point				
		Load	strength	strain	Student't error		Load	strength	strain	Student't error	
	mm	N	Psi	%	strength	strain	N	Psi	%	strength	strain
	3.14	100	768.82	7.80			103	792.12	2.67		
50%resin	3.22	101	758.02	10.17			89.39	670.92	2.33		
	3.29	115	845.59	11.03			96.97	713.01	2.33		
	3.13	107	825.27	12.20			89.39	689.47	2.67		
	3.04	115	914.20	11.07			90.91	722.69	2.33		
Average value			822.38	10.45	60.28	1.57	93.94	717.64	2.47	44.13	0.17
	2.93	162	1334.66	20.50			130.3	1073.52	2.50		
10%boric	2.96	154.5	1259.98	16.90			128.8	1050.29	2.50		
	2.99	148	1197.54	15.10			115.2	931.75	2.50		
	2.91	161.5	1341.21	19.90			130.3	1082.13	2.75		
	2.96	150.5	1230.13	15.10			128.8	1052.66	2.75		
Average value			1272.70	18.10	60.59	2.46	126.7	1038.07	2.60	58.12	0.13
	2.88	106	888.44	7.10			92.42	774.65	1.75		
30%boric	2.76	109	953.26	5.80			90.91	795.04	2.50		
	2.84	115	978.58	7.80			100	850.94	1.50		
	2.60	106	985.26	9.10			92.42	859.07	1.75		
	2.76	109	955.56	8.00			87.88	770.40	1.50		
Average value			952.22	7.45	36.51	1.16	92.73	810.02	1.80	40.24	0.39
	2.64	157	1437.18	41.50			116.7	1067.97	3.00		
50%boric	2.70	154.5	1382.87	28.70			133.3	1193.42	5.00		
	2.70	153	1367.76	35.90			109.1	975.23	2.75		
	2.65	153.5	1401.61	41.10			134.8	1231.30	4.00		
	2.64	157.5	1439.94	31.10			115.2	1052.77	3.25		
Average value			1405.87	36.80	30.68	5.50	121.8	1104.14	3.60	100.80	0.87
	2.41	147	1474.07	76.50			124.2	1245.86	5.00		
10% Na_2S	2.42	147	1467.98	72.60			118.2	1180.19	3.75		
	2.43	145.5	1447.02	57.10			118.2	1175.33	4.25		
	2.44	147	1455.94	63.60			121.2	1200.53	4.50		
	2.48	150	1461.69	61.70			103	1003.99	3.25		
Average value			1461.34	66.30	10.00	7.64	117	1161.18	4.15	87.89	0.64
	2.65	135	1231.13	29.80			90.91	829.05	3.00		
30% Na_2S	2.65	136	1240.25	24.60			81.82	746.14	2.25		
	2.58	127.5	1194.28	19.60			69.7	652.85	1.63		
	2.53	133	1270.42	8.50			75.76	723.64	1.63		
	2.53	132.5	1265.65	32.40			84.85	810.48	2.38		
Average value			1240.35	22.98	29.20	9.03	80.61	752.43	2.18	67.46	0.55
	2.80	101.5	876.04	18.80			63.64	549.24	1.67		
50% Na_2S	2.80	105	906.25	19.60			75.76	653.86	1.88		
	2.80	113	975.30	24.60			72.73	627.71	2.29		
	2.80	110	949.40	19.60			68.18	588.47	1.67		
	2.80	106	914.88	20.10			69.7	601.55	2.71		
Average value			924.38	20.54	36.85	2.21	70	604.17	2.04	37.82	0.43
	2.38	204	2074.33	288.00			133.3	1355.77	6.67		
Blank	2.36	241	2471.36	343.00			115.2	1180.83	6.67		
	2.41	197	1975.45	268.00			127.3	1276.25	5.00		
	2.36	224.5	2302.16	319.00			130.3	1336.21	6.67		
	2.37	194.5	1980.51	258.00			119.7	1218.82	5.00		
Average va			2160.76	288.00	208.22	33.80	125.2	1273.58	6.00	71.17	0.87

ตาราง ผ.3 เส้นผ่าศูนย์กลาง ความหนา และน้ำหนักของชิ้นงานในการทดสอบความทนทานต่อสารเคมี

sample code	Initial state				after immersion				%change	
	d1	d2	thick	weight	d1	d2	thick	weight	volume	weight
10,R,NaCl,1	16.45	16.45	2.75	0.52	16.45	16.51	2.81	0.53	2.55	1.93
10,R,NaCl,2	16.47	16.46	2.72	0.50	16.50	16.56	2.81	0.52	4.13	2.59
10,R,NaCl,3	16.4	16.52	2.69	0.51	16.48	16.50	2.81	0.53	4.84	3.54
10,R,Na_2CO_3,1	16.59	16.45	2.75	0.52	16.49	16.56	2.86	0.53	4.06	2.70
10,R,Na_2CO_3,2	16.44	16.44	2.83	0.53	16.51	16.51	2.90	0.53	3.35	0.76
10,R,Na_2CO_3,3	16.33	16.51	2.59	0.50	16.66	16.45	2.79	0.51	9.50	1.60
10,R,$CaSO_4$,1	16.36	16.5	2.70	0.53	16.62	16.63	2.89	0.55	9.59	3.60
10,R,$CaSO_4$,2	16.4	16.45	2.84	0.53	16.50	16.62	2.96	0.53	5.95	0.57
10,R,$CaSO_4$,3	16.45	16.52	2.86	0.53	16.44	16.67	2.95	0.53	4.02	-0.38
10,R,H_2SO_4,1	16.43	16.49	2.66	0.53	16.52	16.61	2.80	0.53	6.61	0.38
10,R,H_2SO_4,2	16.39	16.48	2.77	0.53	16.58	16.58	2.87	0.53	5.45	-0.38
10,R,H_2SO_4,3	16.33	16.48	2.76	0.53	16.48	16.51	2.87	0.53	5.13	0.38
10,R,H_2O_2,1	16.43	16.57	2.39	0.49	16.63	16.69	2.51	0.48	7.07	-3.26
10,R,H_2O_2,2	16.35	16.52	2.45	0.50	16.54	16.66	2.65	0.48	10.35	-3.21
10,R,H_2O_2,3	16.37	16.43	2.82	0.55	16.51	16.64	2.98	0.58	7.94	6.58
30,R,NaCl,1	16.45	16.57	2.52	0.50	16.56	16.65	2.68	0.50	7.58	1.01
30,R,NaCl,2	16.44	16.43	2.58	0.52	16.68	16.60	2.92	0.53	16.02	1.73
30,R,NaCl,3	16.32	16.4	2.59	0.53	16.56	16.73	2.95	0.52	17.90	-0.76
30,R,Na_2CO_3,1	16.49	16.51	2.50	0.52	16.51	16.61	2.72	0.51	9.59	-0.58
30,R,Na_2CO_3,2	16.41	16.42	2.44	0.50	16.53	16.63	2.65	0.50	10.80	-0.60
30,R,Na_2CO_3,3	16.39	16.43	2.53	0.52	16.70	16.72	2.87	0.52	17.62	-0.58
30,R,$CaSO_4$,1	16.35	16.4	2.55	0.52	16.55	16.68	2.85	0.52	15.06	0.39
30,R,$CaSO_4$,2	16.43	16.53	2.56	0.52	16.69	16.88	2.86	0.53	15.89	1.34
30,R,$CaSO_4$,3	16.35	16.47	2.46	0.50	16.43	16.77	2.67	0.51	11.06	2.59
30,R,H_2SO_4,1	16.42	16.45	2.56	0.52	16.70	16.76	2.90	0.52	17.38	1.35
30,R,H_2SO_4,2	16.36	16.45	2.52	0.52	16.52	16.69	2.79	0.52	13.43	0.38
30,R,H_2SO_4,3	16.47	16.49	2.51	0.53	16.69	16.89	2.84	0.54	17.44	1.31
30,R,H_2O_2,1	16.45	16.5	2.58	0.53	16.65	16.79	2.99	0.55	19.36	2.82
30,R,H_2O_2,2	16.42	16.44	2.46	0.51	16.56	16.61	2.76	0.53	14.32	2.73
30,R,H_2O_2,3	16.37	16.52	2.47	0.51	16.56	16.58	2.67	0.51	9.75	0.98
50,R,NaCl,1	16.42	16.48	3.28	0.60	16.62	16.75	3.47	0.65	8.84	9.40
50,R,NaCl,2	16.41	16.47	3.37	0.59	16.67	16.69	3.49	0.65	6.61	9.60
50,R,NaCl,3	16.44	16.5	3.10	0.59	16.61	16.68	3.29	0.62	8.40	5.95
50,R,Na_2CO_3,1	16.36	16.57	3.22	0.60	16.65	16.93	3.43	0.65	10.77	8.50
50,R,Na_2CO_3,2	16.45	16.52	3.07	0.58	16.65	16.81	3.31	0.65	11.05	11.00
50,R,Na_2CO_3,3	16.44	16.48	2.98	0.58	16.76	16.82	3.16	0.64	10.33	11.13
50,R,$CaSO_4$,1	16.57	16.71	3.01	0.60	16.89	17.04	3.27	0.66	12.92	11.06
50,R,$CaSO_4$,2	16.4	16.54	3.06	0.59	16.63	16.72	3.27	0.65	9.54	9.69
50,R,$CaSO_4$,3	16.44	16.59	3.16	0.58	16.83	16.92	3.45	0.66	13.99	12.93
50,R,H_2SO_4,1	16.49	16.49	3.16	0.57	16.84	16.94	3.37	0.63	11.88	10.10
50,R,H_2SO_4,2	16.4	16.6	3.24	0.60	16.72	16.96	3.49	0.66	12.20	10.23
50,R,H_2SO_4,3	16.46	16.5	2.99	0.60	16.74	16.77	3.30	0.64	14.08	7.39
50,R,H_2O_2,1	16.42	16.53	3.07	0.59	16.73	16.75	3.37	0.65	13.33	9.80
50,R,H_2O_2,2	16.4	16.5	3.16	0.59	16.82	16.85	3.35	0.65	11.03	9.12
50,R,H_2O_2,3	16.43	16.56	2.94	0.59	16.81	16.90	3.33	0.65	18.26	9.31

sample code	Initial state				after immersion				%change	
	d1	d2	thick	weight	d1	d2	thick	weight	volume	weight
10,A,NaCl,1	16.41	16.48	2.75	0.53	16.48	16.52	2.77	0.54	1.40	2.66
10,A,NaCl,2	16.4	16.47	2.72	0.54	16.51	16.51	2.75	0.54	2.03	1.12
10,A,NaCl,3	16.41	16.45	2.77	0.53	16.47	16.49	2.78	0.54	0.97	1.50
10,A,Na_2CO_3,1	16.46	16.48	2.92	0.55	16.48	16.59	2.93	0.55	1.14	0.00
10,A,Na_2CO_3,2	16.39	16.5	2.80	0.56	16.54	16.59	2.81	0.57	1.83	1.97
10,A,Na_2CO_3,3	16.4	16.46	2.61	0.53	16.54	16.79	2.63	0.53	3.67	1.14
10,A,$CaSO_4$,1	16.47	16.54	2.65	0.54	16.49	16.65	2.70	0.56	2.69	3.35
10,A,$CaSO_4$,2	16.43	16.45	2.72	0.54	16.51	16.60	2.74	0.56	2.15	3.31
10,A,$CaSO_4$,3	16.45	16.5	2.84	0.55	16.52	16.54	2.88	0.55	2.09	0.73
10,A,H_2SO_4,1	16.39	16.47	2.93	0.55	16.49	16.53	2.94	0.56	1.32	2.18
10,A,H_2SO_4,2	16.38	16.6	2.82	0.55	16.51	16.74	2.87	0.56	3.45	1.82
10,A,H_2SO_4,3	16.45	16.49	2.74	0.55	16.46	16.56	2.75	0.55	0.85	0.00
10,A,H_2O_2,1	16.38	16.47	2.72	0.54	16.43	16.51	2.74	0.54	1.29	0.56
10,A,H_2O_2,2	16.44	16.49	2.69	0.54	16.41	16.60	2.71	0.54	1.23	-0.18
10,A,H_2O_2,3	16.36	16.6	2.72	0.55	16.39	16.62	2.73	0.56	0.67	0.54
30,A,NaCl,1	16.42	16.46	2.63	0.57	16.49	16.71	2.66	0.56	3.12	-1.74
30,A,NaCl,2	16.4	16.42	2.61	0.56	16.45	16.62	2.64	0.55	2.70	-2.30
30,A,NaCl,3	16.42	16.44	2.70	0.58	16.41	16.48	2.72	0.58	0.92	-0.17
30,A,Na_2CO_3,1	16.4	16.51	2.72	0.57	16.48	16.68	2.75	0.58	2.64	1.57
30,A,Na_2CO_3,2	16.41	16.49	2.78	0.58	16.47	16.54	2.82	0.57	2.12	-1.72
30,A,Na_2CO_3,3	16.47	16.49	2.65	0.58	16.46	16.51	2.68	0.57	1.19	-0.17
30,A,$CaSO_4$,1	16.42	16.48	2.65	0.57	16.53	16.62	2.70	0.56	3.44	-0.88
30,A,$CaSO_4$,2	16.36	16.52	2.61	0.56	16.45	16.57	2.67	0.57	3.17	1.62
30,A,$CaSO_4$,3	16.46	16.48	2.65	0.57	16.49	16.64	2.68	0.57	2.30	0.18
30,A,H_2SO_4,1	16.49	16.51	2.66	0.58	16.50	16.60	2.70	0.58	2.12	-0.35
30,A,H_2SO_4,2	16.37	16.48	2.65	0.57	16.47	16.51	2.71	0.58	3.08	0.52
30,A,H_2SO_4,3	16.38	16.45	2.65	0.57	16.47	16.65	2.72	0.58	4.46	2.29
30,A,H_2O_2,1	16.37	16.48	2.66	0.58	16.42	16.57	2.68	0.58	1.61	1.04
30,A,H_2O_2,2	16.47	16.47	2.64	0.58	16.47	16.59	2.65	0.58	1.11	0.69
30,A,H_2O_2,3	16.44	16.53	2.67	0.58	16.44	16.81	2.73	0.58	3.99	-1.03
50,A,NaCl,1	16.45	16.48	2.49	0.63	16.51	16.51	2.56	0.64	3.37	1.58
50,A,NaCl,2	16.43	16.63	2.58	0.64	16.49	16.69	2.59	0.65	1.12	2.19
50,A,NaCl,3	16.41	16.64	2.54	0.64	16.44	16.67	2.56	0.66	1.15	2.02
50,A,Na_2CO_3,1	16.43	16.46	2.54	0.64	16.46	16.60	2.58	0.65	2.63	1.72
50,A,Na_2CO_3,2	16.41	16.49	2.58	0.64	16.42	16.57	2.58	0.65	0.55	1.71
50,A,Na_2CO_3,3	16.39	16.5	2.52	0.63	16.51	16.57	2.58	0.65	3.57	2.37
50,A,$CaSO_4$,1	16.38	16.49	2.49	0.62	16.38	16.66	2.57	0.63	4.28	2.42
50,A,$CaSO_4$,2	16.44	16.53	2.52	0.63	16.53	16.55	2.57	0.65	2.67	2.84
50,A,$CaSO_4$,3	16.41	16.48	2.57	0.64	16.50	16.67	2.65	0.65	4.88	2.36
50,A,H_2SO_4,1	16.42	16.52	2.78	0.64	16.58	16.61	2.87	0.64	4.81	0.00
50,A,H_2SO_4,2	16.42	16.45	2.48	0.63	16.44	16.59	2.59	0.64	5.45	1.27
50,A,H_2SO_4,3	16.42	16.51	2.54	0.65	16.57	16.65	2.59	0.65	3.77	0.00
50,A,H_2O_2,1	16.45	16.45	2.54	0.64	16.51	16.52	2.58	0.64	2.38	1.10
50,A,H_2O_2,2	16.3	16.49	2.42	0.61	16.44	16.57	2.46	0.62	3.02	0.49
50,A,H_2O_2,3	16.36	16.39	2.61	0.64	16.52	16.53	2.62	0.65	2.23	0.94

sample code	Initial state				after immersion				%change	
	d1	d2	thick	weight	d1	d2	thick	weight	volume	weight
10,S,NaCl,1	16.51	16.54	2.52	0.56	16.51	16.62	2.54	0.57	1.28	0.71
10,S,NaCl,2	16.47	16.53	2.56	0.58	16.53	16.62	2.60	0.59	2.49	0.86
10,S,NaCl,3	16.4	16.48	2.65	0.60	16.43	16.67	2.66	0.60	1.73	0.50
10,S,Na_2CO_3,1	16.36	16.51	2.53	0.58	16.41	16.39	2.58	0.58	1.54	0.87
10,S,Na_2CO_3,2	16.41	16.5	2.60	0.59	16.47	16.59	2.62	0.59	1.69	1.02
10,S,Na_2CO_3,3	16.46	16.56	2.45	0.56	16.50	16.53	2.49	0.57	1.69	1.43
10,S,$CaSO_4$,1	16.49	16.54	2.53	0.59	16.49	16.57	2.59	0.60	2.56	0.85
10,S,$CaSO_4$,2	16.4	16.53	2.55	0.58	16.43	16.66	2.64	0.58	4.54	0.69
10,S,$CaSO_4$,3	16.44	16.51	2.66	0.57	16.51	16.58	2.73	0.58	3.51	0.87
10,S,H_2SO_4,1	16.44	16.46	2.65	0.60	16.48	16.52	2.73	0.61	3.65	1.17
10,S,H_2SO_4,2	16.36	16.49	2.55	0.59	16.42	16.56	2.63	0.59	3.96	0.00
10,S,H_2SO_4,3	16.45	16.5	2.65	0.59	16.49	16.51	2.68	0.59	1.44	0.34
10,S,H_2O_2,1	16.37	16.41	2.57	0.56	16.42	16.52	2.63	0.57	3.34	0.71
10,S,H_2O_2,2	16.37	16.49	2.76	0.59	16.48	16.60	2.87	0.59	5.38	0.00
10,S,H_2O_2,3	16.37	16.45	2.57	0.58	16.45	16.52	2.63	0.59	3.27	1.38
30,S,NaCl,1	16.37	16.47	2.44	0.49	16.40	16.56	2.45	0.50	1.14	0.81
30,S,NaCl,2	16.36	16.46	2.52	0.51	16.48	16.55	2.52	0.51	1.28	0.00
30,S,NaCl,3	16.43	16.45	2.53	0.51	16.32	16.53	2.52	0.50	-0.58	-0.40
30,S,Na_2CO_3,1	16.4	16.45	2.51	0.51	16.46	16.55	2.55	0.50	2.59	-1.57
30,S,Na_2CO_3,2	16.38	16.47	2.49	0.51	16.45	16.49	2.52	0.51	1.76	0.59
30,S,Na_2CO_3,3	16.41	16.49	2.51	0.51	16.49	16.52	2.54	0.51	1.87	1.39
30,S,$CaSO_4$,1	16.39	16.43	2.46	0.50	16.42	16.50	2.49	0.51	1.84	1.61
30,S,$CaSO_4$,2	16.36	16.51	2.45	0.50	16.45	16.51	2.49	0.51	2.19	2.81
30,S,$CaSO_4$,3	16.41	16.46	2.45	0.50	16.42	16.54	2.53	0.51	3.83	1.79
30,S,H_2SO_4,1	16.34	16.52	2.45	0.50	16.38	16.58	2.49	0.51	2.25	1.61
30,S,H_2SO_4,2	16.39	16.51	2.44	0.50	16.39	16.52	2.47	0.50	1.29	0.81
30,S,H_2SO_4,3	16.36	16.44	2.43	0.50	16.41	16.51	2.47	0.50	2.39	0.40
30,S,H_2O_2,1	16.39	16.5	2.42	0.49	16.41	16.55	2.45	0.50	1.67	2.67
30,S,H_2O_2,2	16.47	16.48	2.44	0.50	16.48	16.50	2.46	0.50	1.00	-0.20
30,S,H_2O_2,3	16.45	16.48	2.44	0.50	16.40	16.49	2.47	0.51	0.98	1.39
50,S,NaCl,1	16.5	16.52	2.53	0.67	16.50	16.61	2.56	0.67	1.74	0.60
50,S,NaCl,2	16.47	16.53	2.52	0.66	16.50	16.58	2.55	0.67	1.68	1.67
50,S,NaCl,3	16.46	16.51	2.61	0.67	16.48	16.63	2.64	0.69	2.01	1.63
50,S,Na_2CO_3,1	16.38	16.42	2.55	0.68	16.46	16.54	2.58	0.67	2.41	-0.15
50,S,Na_2CO_3,2	16.35	16.39	2.51	0.67	16.45	16.50	2.58	0.68	4.11	1.79
50,S,Na_2CO_3,3	16.34	16.43	2.53	0.67	16.54	16.36	2.63	0.68	4.78	1.94
50,S,$CaSO_4$,1	16.38	16.38	2.65	0.68	16.43	16.49	2.69	0.70	2.50	2.06
50,S,$CaSO_4$,2	16.33	16.33	2.58	0.68	16.42	16.54	2.62	0.68	3.42	0.89
50,S,$CaSO_4$,3	16.42	16.49	2.43	0.64	16.47	16.49	2.54	0.65	4.84	1.25
50,S,H_2SO_4,1	16.43	16.51	2.58	0.69	16.37	16.62	2.63	0.70	2.25	1.31
50,S,H_2SO_4,2	16.36	16.5	2.51	0.66	16.55	16.66	2.55	0.67	3.77	1.51
50,S,H_2SO_4,3	16.41	16.53	2.56	0.68	16.40	16.51	2.60	0.69	1.38	2.52
50,S,H_2O_2,1	16.4	16.51	2.54	0.67	16.41	16.62	2.58	0.68	2.32	0.74
50,S,H_2O_2,2	16.38	16.4	2.59	0.69	16.53	16.57	2.65	0.69	4.32	0.87
50,S,H_2O_2,3	16.46	16.49	2.56	0.68	16.45	16.52	2.61	0.69	2.08	2.51

sample code	Initial state				after immersion				%change	
	d1	d2	thick	weight	d1	d2	thick	weight	volume	weight
10,So,NaCl,1	16.4	16.44	2.41	0.50	16.41	16.43	2.41	0.49	0.00	-0.20
10,So,NaCl,2	16.43	16.47	2.44	0.50	16.37	16.54	2.44	0.50	0.06	-0.40
10,So,NaCl,3	16.42	16.55	2.44	0.51	16.39	16.68	2.45	0.50	1.02	-1.96
10,So,Na_2CO_3,1	16.39	16.47	2.40	0.50	16.42	16.46	2.40	0.49	0.12	-1.40
10,So,Na_2CO_3,2	16.45	16.46	2.46	0.50	16.41	16.49	2.47	0.50	0.35	0.00
10,So,Na_2CO_3,3	16.37	16.52	2.47	0.50	16.38	16.53	2.46	0.50	-0.28	-0.20
10,So,$CaSO_4$,1	16.42	16.46	2.41	0.50	16.54	16.55	2.42	0.49	1.70	-0.40
10,So,$CaSO_4$,2	16.38	16.59	2.42	0.50	16.43	16.55	2.44	0.50	0.89	-1.20
10,So,$CaSO_4$,3	16.44	16.5	2.42	0.49	16.36	16.60	2.44	0.49	0.95	-0.20
10,So,H_2SO_4,1	16.41	16.5	2.43	0.50	16.44	16.67	2.44	0.50	1.64	0.40
10,So,H_2SO_4,2	16.41	16.44	2.41	0.49	16.46	16.49	2.42	0.50	1.03	0.61
10,So,H_2SO_4,3	16.44	16.45	2.44	0.50	16.45	16.46	2.46	0.50	0.94	0.00
10,So,H_2O_2,1	16.5	16.53	2.41	0.50	16.38	16.77	2.43	0.50	1.56	-0.40
10,So,H_2O_2,2	16.32	16.52	2.45	0.50	16.41	16.51	2.47	0.50	1.31	0.00
10,So,H_2O_2,3	16.41	16.47	2.40	0.50	16.43	16.46	2.43	0.50	1.31	0.20
30,So,NaCl,1	16.37	16.41	2.62	0.50	16.34	16.52	2.62	0.57	0.49	13.49
30,So,NaCl,2	16.38	16.45	2.77	0.58	16.48	16.53	2.79	0.58	1.83	-0.86
30,So,NaCl,3	16.36	16.42	2.57	0.57	16.33	16.46	2.60	0.57	1.23	-0.70
30,So,Na_2CO_3,1	16.39	16.39	2.65	0.58	16.37	16.46	2.69	0.57	1.82	-1.55
30,So,Na_2CO_3,2	16.43	16.45	2.56	0.58	16.40	16.43	2.56	0.58	-0.30	-0.52
30,So,Na_2CO_3,3	16.33	16.51	2.57	0.59	16.40	16.44	2.58	0.59	0.39	0.34
30,So,$CaSO_4$,1	16.46	16.46	2.60	0.59	16.45	16.50	2.61	0.59	0.57	-1.35
30,So,$CaSO_4$,2	16.36	16.46	2.53	0.58	16.40	16.48	2.62	0.58	3.94	0.35
30,So,$CaSO_4$,3	16.4	16.54	2.56	0.59	16.36	16.49	2.61	0.58	1.40	-1.02
30,So,H_2SO_4,1	16.39	16.43	2.66	0.60	16.40	16.47	2.67	0.59	0.68	-0.67
30,So,H_2SO_4,2	16.42	16.46	2.55	0.59	16.42	16.50	2.60	0.58	2.21	-1.02
30,So,H_2SO_4,3	16.36	16.45	2.62	0.58	16.41	16.46	2.62	0.58	0.37	0.00
30,So,H_2O_2,1	16.38	16.43	2.56	0.59	16.43	16.60	2.58	0.58	2.14	-1.19
30,So,H_2O_2,2	16.39	16.52	2.62	0.59	16.46	16.56	2.63	0.59	1.05	0.00
30,So,H_2O_2,3	16.29	16.44	2.70	0.59	16.31	16.40	2.72	0.58	0.62	-1.19
50,So,NaCl,1	16.38	16.49	2.94	0.73	16.43	16.54	2.92	0.71	-0.08	-3.14
50,So,NaCl,2	16.38	16.48	2.90	0.71	16.39	16.54	2.91	0.69	0.77	-2.55
50,So,NaCl,3	16.36	16.41	3.05	0.72	16.43	16.51	3.06	0.69	1.37	-3.88
50,So,Na_2CO_3,1	16.39	16.49	2.69	0.72	16.42	16.55	2.85	0.68	6.53	-5.29
50,So,Na_2CO_3,2	16.39	16.43	2.90	0.71	16.41	16.52	2.93	0.69	1.71	-3.23
50,So,Na_2CO_3,3	16.42	16.52	2.86	0.73	16.46	16.51	2.88	0.70	0.88	-3.85
50,So,$CaSO_4$,1	16.4	16.43	2.97	0.71	16.48	16.58	3.18	0.70	8.58	-2.24
50,So,$CaSO_4$,2	16.38	16.45	2.84	0.71	16.39	16.52	2.97	0.69	5.09	-3.23
50,So,$CaSO_4$,3	16.42	16.46	2.68	0.70	16.47	16.72	2.79	0.67	6.08	-4.40
50,So,H_2SO_4,1	16.45	16.48	2.82	0.73	16.49	16.50	2.95	0.69	4.99	-5.75
50,So,H_2SO_4,2	16.43	16.45	2.70	0.71	16.44	16.66	2.78	0.67	4.35	-6.06
50,So,H_2SO_4,3	16.51	16.51	2.84	0.71	16.47	16.53	2.85	0.67	0.23	-4.54
50,So,H_2O_2,1	16.4	16.45	2.98	0.73	16.46	16.57	2.98	0.69	1.10	-5.76
50,So,H_2O_2,2	16.46	16.47	2.95	0.72	16.43	16.55	2.96	0.68	0.64	-4.34
50,So,H_2O_2,3	16.46	16.44	2.94	0.72	16.40	16.53	2.94	0.70	0.18	-4.01

sample code	Initial state				after immersion				%change	
	d1	d2	thick	weight	d1	d2	thick	weight	volume	weight
10,B,NaCl,1	16.43	16.54	2.94	0.63	16.44	16.54	3.01	0.62	2.44	-1.11
10,B,NaCl,2	16.4	16.47	2.94	0.62	16.51	16.58	3.01	0.62	3.76	-0.64
10,B,NaCl,3	16.42	16.51	2.93	0.63	16.47	16.53	2.99	0.63	2.48	-0.32
10,B,Na_2CO_3,1	16.4	16.47	2.96	0.61	16.54	16.62	3.01	0.63	3.49	1.96
10,B,Na_2CO_3,2	16.41	16.49	2.91	0.64	16.43	16.57	2.96	0.63	2.34	-1.42
10,B,Na_2CO_3,3	16.47	16.54	2.90	0.64	16.49	16.55	2.97	0.64	2.60	0.94
10,B,$CaSO_4$,1	16.45	16.53	2.92	0.62	16.51	16.54	2.99	0.62	2.83	-1.28
10,B,$CaSO_4$,2	16.43	16.48	2.89	0.64	16.43	16.58	2.99	0.64	4.09	-0.31
10,B,$CaSO_4$,3	16.44	16.54	3.03	0.62	16.48	16.62	3.06	0.63	1.73	1.12
10,B,H_2SO_4,1	16.39	16.47	2.99	0.64	16.46	16.49	3.03	0.63	1.89	-0.63
10,B,H_2SO_4,2	16.47	16.5	2.91	0.62	16.43	16.54	3.00	0.62	3.09	-0.32
10,B,H_2SO_4,3	16.48	16.52	2.92	0.62	16.48	16.52	2.96	0.61	1.37	-1.61
10,B,H_2O_2,1	16.45	16.48	2.97	0.62	16.50	16.55	3.08	0.63	4.46	0.96
10,B,H_2O_2,2	16.48	16.52	2.88	0.63	16.48	16.55	2.95	0.63	2.62	-0.47
10,B,H_2O_2,3	16.41	16.46	2.93	0.64	16.47	16.52	2.95	0.63	1.42	-1.10
30,B,NaCl,1	16.44	16.55	2.77	0.64	16.48	16.54	2.83	0.65	2.35	1.40
30,B,NaCl,2	16.48	16.48	2.82	0.65	16.51	16.54	2.86	0.65	1.97	-0.31
30,B,NaCl,3	16.42	16.53	2.86	0.64	16.47	16.57	2.87	0.64	0.90	0.00
30,B,Na_2CO_3,1	16.46	16.49	2.85	0.62	16.54	16.61	3.02	0.63	7.26	1.29
30,B,Na_2CO_3,2	16.46	16.59	2.82	0.64	16.55	16.62	3.00	0.64	7.16	-0.31
30,B,Na_2CO_3,3	16.43	16.47	2.95	0.64	16.49	16.53	3.03	0.64	3.46	0.94
30,B,$CaSO_4$,1	16.46	16.49	2.82	0.65	16.54	16.59	2.98	0.66	6.83	1.85
30,B,$CaSO_4$,2	16.46	16.54	2.82	0.62	16.61	16.66	2.98	0.65	7.41	4.33
30,B,$CaSO_4$,3	16.35	16.54	2.74	0.64	16.48	16.61	3.02	0.65	11.56	1.56
30,B,H_2SO_4,1	16.58	16.68	2.79	0.63	16.46	16.58	2.88	0.63	1.86	-0.63
30,B,H_2SO_4,2	16.42	16.44	2.89	0.62	16.52	16.54	2.96	0.62	3.67	0.32
30,B,H_2SO_4,3	16.37	16.54	2.97	0.64	16.54	16.55	2.99	0.64	1.78	-0.63
30,B,H_2O_2,1	16.39	16.54	2.77	0.64	16.50	16.69	2.86	0.64	4.89	0.47
30,B,H_2O_2,2	16.34	16.35	2.77	0.64	16.42	16.57	2.80	0.64	2.95	0.47
30,B,H_2O_2,3	16.25	16.51	2.73	0.63	16.44	16.54	2.85	0.63	5.80	0.32
50,B,NaCl,1	16.39	16.46	2.82	0.53	16.47	16.50	2.84	0.53	1.45	0.38
50,B,NaCl,2	16.5	16.54	2.75	0.52	16.49	16.50	2.72	0.53	-1.39	0.76
50,B,NaCl,3	16.36	16.44	2.67	0.52	16.46	16.55	2.71	0.52	2.80	0.39
50,B,Na_2CO_3,1	16.41	16.62	2.82	0.52	16.44	16.53	2.82	0.52	-0.36	0.19
50,B,Na_2CO_3,2	16.41	16.53	2.69	0.53	16.50	16.67	2.66	0.53	0.27	0.38
50,B,Na_2CO_3,3	16.44	16.46	2.65	0.53	16.49	16.51	2.68	0.53	1.75	0.76
50,B,$CaSO_4$,1	16.48	16.49	2.92	0.52	16.54	16.49	3.00	0.54	3.11	2.88
50,B,$CaSO_4$,2	16.35	16.47	2.77	0.53	16.53	16.67	2.87	0.54	6.02	2.27
50,B,$CaSO_4$,3	16.35	16.37	3.09	0.51	16.44	16.50	3.21	0.52	5.29	2.54
50,B,H_2SO_4,1	16.35	16.54	2.76	0.52	16.47	16.53	2.85	0.53	3.95	0.38
50,B,H_2SO_4,2	16.47	16.48	2.60	0.52	16.44	16.50	2.69	0.53	3.40	0.76
50,B,H_2SO_4,3	16.37	16.47	2.61	0.51	16.47	16.54	2.64	0.52	2.20	0.78
50,B,H_2O_2,1	16.4	16.46	2.75	0.52	16.50	16.50	2.83	0.54	3.79	2.49
50,B,H_2O_2,2	16.45	16.48	2.64	0.52	16.52	16.52	2.76	0.53	5.25	1.54
50,B,H_2O_2,3	16.33	16.54	2.60	0.51	16.49	16.60	2.71	0.51	5.63	0.39

sample code	Initial state				after immersion				%change	
	d1	d2	thick	weight	d1	d2	thick	weight	volume	weight
B,NaCl,1	16.27	16.39	2.34	0.46	16.33	16.48	2.38	0.46	2.65	0.00
B,NaCl,2	16.28	16.32	2.45	0.47	16.33	16.41	2.44	0.48	0.45	1.91
B,NaCl,3	16.34	16.39	2.36	0.46	16.36	16.43	2.41	0.46	2.49	1.09
B,Na_2CO_3,1	16.25	16.4	2.40	0.46	16.40	16.42	2.39	0.46	0.62	0.00
B,Na_2CO_3,2	16.27	16.36	2.43	0.48	16.32	16.40	2.47	0.47	2.21	-1.88
B,Na_2CO_3,3	16.29	16.32	2.40	0.46	16.32	16.41	2.36	0.46	-0.94	0.00
B,$CaSO_4$,1	16.25	16.35	2.45	0.49	16.32	16.48	2.51	0.47	3.71	-2.27
B,$CaSO_4$,2	16.23	16.33	2.32	0.46	16.35	16.43	2.34	0.45	2.23	-2.40
B,$CaSO_4$,3	16.26	16.34	2.35	0.46	16.38	16.40	2.39	0.46	2.83	-0.65
B,H_2SO_4,1	16.29	16.35	2.47	0.49	16.32	16.35	2.48	0.48	0.59	-3.04
B,H_2SO_4,2	16.28	16.32	2.42	0.48	16.34	16.63	2.42	0.47	2.28	-1.46
B,H_2SO_4,3	16.23	16.38	2.36	0.47	16.33	16.46	2.42	0.47	3.68	0.64
B,H_2O_2,1	16.29	16.33	2.32	0.46	16.30	16.47	2.34	0.46	1.79	0.66
B,H_2O_2,2	16.35	16.37	2.34	0.46	16.30	16.46	2.36	0.46	1.10	1.53
B,H_2O_2,3	16.3	16.38	2.32	0.47	16.36	16.48	2.37	0.47	3.16	0.00

ความหมายของ sample code ในตาราง ตัวเลข, ตัวอักษร, ตัวอักษร, ตัวเลข คือ จำนวนกาก ในระบบเป็นเปอร์เซนต์ ชนิดของกากฯ ชนิดของสารละลาย และ จำนวนตัวอย่าง ตามลำดับ โดย R-เรซิน A-เถ้า S-สลัดจ์ So-โซเดียมซัลเฟต B-กรดบอริก และ B-blank สำหรับชนิดของกากฯ NaCl-สารละลายโซเดียมคลอไรด์ Na_2CO_3-สารละลายโซเดียมคาร์บอเนต Ca_2SO_4-สารละลายแคลเซียมซัลเฟต H_2SO_4-สารละลายกรดซัลฟิวริก H_2O_2-สารละลายไฮโดรเจนเปอร์ออกไซด์ ตามลำดับ

การคำนวณค่าดัชนีการถูกชะล้าง (Leach Index Calculation)

การดำเนินการทดลองและการคำนวณเป็นไปตามมาตรฐาน ANS/ANSI-16.1,1986. ซึ่งต้องการค่าต่างๆในการคำนวณดังนี้

1.กัมมันตภาพรังสีที่วัดได้ในน้ำ (activity released (A_i) into leachant) วัดแยกกันระหว่าง Cs-137 และ Co-60 การคำนวณก็ต้องแยกกันด้วยเช่นกัน เนื่องจากต้องมีค่าครึ่งชีวิตเข้ามาเป็นปัจจัยหนึ่งในการคำนวณค่าแก้ของเวลา (time correction) ค่ากัมมันตภาพรังสีของซีเซียม-137 (A_{cs}) และโคบอลต์-60 (A_{co}) ในส่วนนี้สามารถวัดได้จากการเปรียบเทียบค่าพื้นที่ใต้พีคซีเซียม (P_{cs}) และพื้นที่ใต้พีคโคบอลต์ (P_{co}) เทียบกับค่าพื้นที่ใต้พีคของซีเซียมมาตราฐาน (P_{csS}) และพื้นที่ใต้พีคของโคบอลต์มาตราฐาน (P_{coS}) ของสารมาตรฐานซึ่งทราบความแรงรังสี A_{csS} และ A_{coS}ที่แน่นอน

2.ค่าคงที่การสลายตัวมีค่าเท่ากับ $\ln(2)/T_{1/2}$ เมื่อ $T_{1/2}$ คือครึ่งชีวิตของไอโซโทปรังสี

3.เวลาที่กำหนดทั้งหมด 10 ช่วง (time interval(t_n) of standard measurement) มีหน่วยเป็นวินาที

4.ช่วงเวลาระหว่างเวลาที่กำหนดในแต่ละช่วง (Δt_n)

5.จำนวนของสารละลายหรือจำนวนช่วงเวลา ใช้สัญญลักษณ์ (i) ในกรณีของตัวแปรที่ไม่ใช่เวลาและใช้สัญญลักษณ์ (n) ในกรณีตัวแปรเวลาเพื่อความไม่สับสนในการคำนวณ

6.พื้นที่ผิวของตัวอย่าง (Surface area : S) มีหน่วยเป็น cm^2

7.ปริมาตรของตัวอย่าง (Vloume : V) มีหน่วยเป็น cm^3

สมการที่ใช้คำนวณค่าต่างๆดังนี้

$$A_{cs}(i) = A_{csS} \times P_{cs}(i)/P_{csS}$$

$$A_{co}(i) = A_{coS} \times P_{co}(i)/P_{coS}$$

ทำการแก้ค่าเวลาได้จากสมการ

$$A = A_0 \times e^{-\lambda t}$$

จากนั้นหาค่าสัดส่วนการหลุดรอดของกัมมันตภาพรังสี (Activity released fraction : F) ในน้ำจากสมการ

$$F = A_{cs}(i)/A_{cs}(0)$$

เมื่อ $A_{cs}(0)$ คือความแรงรังสีที่เวลาเริ่มต้น

ตัวแปรสำคัญอีกค่าหนึ่งที่ใช้ในการคำนวณหาดัชนีการถูกชะล้าง (Leach index) คือค่า Effective diffusivity : D_i ซึ่งสามารถคำนวณได้จากสมการต่อไปนี้

$$\text{Effective diffusivity : } D_i = \pi \times [F/\Delta t_n]^2 \times [V/S]^2 \times T$$

$$T = [1/2(t_n^{1/2} + t_{n-1}^{1/2})]^2$$

$$L_i = (1/\log D_i)$$

$$L = \text{average}(L_i)$$

รายละเอียดของข้อมูลและการคำนวณโดยละเอียด ของชิ้นงานตัวอย่างชนิดต่างๆ จะถูกแสดงไว้ในหน้าถัดจากนี้ เพื่อความสะดวกในการวิเคราะห์ผลการทดลอง จึงได้ทำการพล็อตข้อมูลระหว่างค่าสัดส่วนการหลุดรอดของกัมมันตภาพรังสีสะสม (Cummulative Activity released fraction) ซึ่งมีค่าเท่ากับผลรวมของค่าสัดส่วนนั้นจากเริ่มต้นจนถึงเวลาที่จุดสนใจ และเวลาที่ใช้ในการแช่ตัวอย่าง กราฟที่ได้ได้ถูกแสดงในส่วนของผลการทดลองในบทที่ 4

ตาราง ผ.4-1 DATA FOR LEACH INDEX MEASUREMENT AND CALCULATION METHOD SHEET FOR 10% ASH WASTE FORMS

SAMPLE DESCRIPTION:	**10.65**	**%ash waste**	ash(g)	LDPE(g)	Time factor	0.00154	PI =	3.14		
DATE/MONTH/YEAR:	07/06/1996		0.5382	4.5167	**LEACHANT VOL(cm3)**	223.93				
CALCULATED LEACH INDEX:	**7.38**	**10.86**	Cs activity	Co activity	**SURFACE AREA(cm2)**	22.39				
INITIAL ACTIVITY FROM USE FRACTION OF SIMULATED WASTE			1.21E-02	7.76E-02	**SPECIMEN VOL(cm3)**	7.07				
ACTIVITY OF SIMULATED WASTE INTEGRAL AREA PER GRAM			9.94E+04	5.60E+04		gram	area	ACTIVITY uCi/g AT		
USE FRACTION	0.72029703	T1/2(sec)	9.46E+08	1.58E+08	Cs-137	5.452	307905	31.1E-3	19/7/96/14.37	
OVERALL WASTE WEIGHT(g)=	8.08				Co-60	5.452	911088	200.2E-3	19/7/96/14.37	
ACTUAL WASTE WEIGHT(g)=	5.82					ml.	area	ACTIVITY uCi/g AT		
DIAMETER(cm)=	1.5				STD.Co-60	0.2	1052196	135.7E-3	10/5/96/10:00	
LENGTH(cm)=	4				STD.Cs-137	.2	244545	135.4E-3	10/5/96/10:00	

Leach Rate ($g.cm^{-2}.d^{-1}$)	
Cs-137	**Co-60**
1.09E-04	**1.46E-05**

INTERVAL			count/3000 sec		activity released		released fraction : F		Effective Diffusivity cm2/s		Leachability Index	
T:(HR)	TOTAL	DELTA	Cs-137	Co-60	Cs-137	Co-60	F(cs)=An/Ao	F(co)=An/Ao	Di(Cs)	Di(Co)	Li(Cs)	Li(Co)
2	7200	7200	1088	148	1.1E-04	3.3E-05	9.1E-03	4.2E-04	9.0E-10	1.9E-12	9.04	11.72
7	25200	18000	2582	132	2.6E-04	2.9E-05	3.1E-02	7.9E-04	1.4E-08	9.0E-12	7.87	11.04
24	86400	61200	4572	150	4.6E-04	3.3E-05	6.9E-02	1.2E-03	2.0E-08	6.4E-12	7.69	11.20
47	169200	82800	4491	105	4.5E-04	2.3E-05	1.1E-01	1.5E-03	6.5E-08	1.3E-11	7.19	10.88
72	259200	90000	3103	111	3.1E-04	2.4E-05	1.3E-01	1.8E-03	1.4E-07	2.7E-11	6.84	10.56
96	345600	86400	2656	108	2.7E-04	2.4E-05	1.5E-01	2.1E-03	3.0E-07	5.8E-11	6.52	10.24
120	432000	86400	4290	569	4.3E-04	1.3E-04	1.9E-01	3.7E-03	5.9E-07	2.3E-10	6.23	9.64
457.5	1647000	1215000	18954	391	1.9E-03	8.7E-05	3.5E-01	4.9E-03	2.4E-08	4.7E-12	7.61	11.33
1176	4233600	2586600	18195	1223	1.8E-03	2.7E-04	5.0E-01	8.4E-03	3.3E-08	9.2E-12	7.48	11.04
2160	7776000	3542400	7381	214	7.5E-04	4.9E-05	5.6E-01	9.0E-03	4.7E-08	1.2E-11	7.33	10.92

ตาราง ผ.4-2 DATA FOR LEACH INDEX MEASUREMENT AND CALCULATION METHOD SHEET FOR 30% ASH WASTE FORMS

SAMPLE DESCRIPTION:	**29.95**	**%ash waste**	ash(g)	LDPE(g)	Time factor	1.54E-03	PI =	3.14			
DATE/MONTH/YEAR:	16/09/1996		1.5043	3.51876	**LEACHANT VOL(cm3)**	213.40					
CALCULATED LEACH INDEX:	**8.24**	**10.12**	Cs activity	Co activity	**SURFACE AREA(cm2)**	21.34					
INITIAL ACTIVITY FROM USE FRACTION OF SIMULATED WASTE			4.01E-02	2.58E-01	**SPECIMEN VOL(cm3)**	6.39					
ACTIVITY OF SIMULATED WASTE INTEGRAL AREA PER GRAM			9.94E+04	5.60E+04		gram	area	ACTIVITY uCi/g AT			
USE FRACTION	0.86	T1/2(sec)	9.46E+08	1.58E+08	Cs-137	5.452	307905	3.11E-02	19/7/96/14.37		
OVERALL WASTE WEIGHT(g)=	4.93	**Leach Rate (g.cm-2.d-1)**			Co-60	5.452	911088	2.00E-01	19/7/96/14.37		
ACTUAL WASTE WEIGHT(g)=	4.22	**Cs-137**	**Co-60**			ml.	area	ACTIVITY uCi/g AT			
DIAMETER(cm)=	1.40	**1.58E-04**	**1.81E-05**		STD.Co-60	0.2	1052196	1.36E-01	10/5/96/10:00		
LENGTH(cm)=	4.15				STD.Cs-137	2	244545	1.35E-01	10/5/96/10:00		

INTERVAL			count/3000 sec		activity released		released fraction : F		Effective Diffusivity cm2/s		Leachability Index	
T:(HR)	TOTAL	DELTA	Cs-137	Co-60	Cs-137	Co-60	F(cs)=An/Ao	F(co)=An/Ao	Di(Cs)	Di(Co)	Li(Cs)	Li(Co)
2	7200	7200	2108	3046	2.14E-04	6.84E-04	5.34E-03	2.65E-03	2.79E-10	6.89E-11	9.56	10.16
7	25200	18000	2782	408	2.82E-04	9.16E-05	1.24E-02	3.01E-03	1.98E-09	1.17E-10	8.70	9.93
24	86400	61200	5438	698	5.52E-04	1.57E-04	2.61E-02	3.62E-03	2.63E-09	5.04E-11	8.58	10.30
49.4	177840	91440	5582	631	5.67E-04	1.42E-04	4.03E-02	4.17E-03	7.00E-09	7.49E-11	8.15	10.13
72	259200	81360	3688	561	3.74E-04	1.26E-04	4.96E-02	4.66E-03	2.27E-08	2.00E-10	7.64	9.70
96	345600	86400	4001	1145	4.06E-04	2.58E-04	5.97E-02	5.65E-03	4.05E-08	3.63E-10	7.39	9.44
120	432000	86400	3494	1467	3.55E-04	3.30E-04	6.86E-02	6.93E-03	6.88E-08	7.04E-10	7.16	9.15
456	1641600	1209600	15776	2208	1.60E-03	4.99E-04	1.09E-01	8.87E-03	2.13E-09	1.42E-11	8.67	10.85
1128	4060800	2419200	28080	2652	2.86E-03	6.06E-04	1.80E-01	1.12E-02	4.23E-09	1.65E-11	8.37	10.78
2160	7776000	3715200	21665	356	2.21E-03	8.29E-05	2.35E-01	1.15E-02	6.51E-09	1.57E-11	8.19	10.80

ตาราง ผ.4-3 DATA FOR LEACH INDEX MEASUREMENT AND CALCULATION METHOD SHEET FOR 50% ASH WASTE FORMS

SAMPLE DESCRIPTION:	49.89	%ash waste		ash(g)	LDPE(g)	Time factor	1.54E-03	PI =	3.14		
DATE/MONTH/YEAR:	16/09/1996			2.5055	2.51685	LEACHANT VOL(cm3)		271.07			
CALCULATED LEACH INDEX:	7.66	9.90		Cs activity	Co activity	SURFACE AREA(cm2)		27.11			
INITIAL ACTIVITY FROM USE FRACTION OF SIMULATED WASTE				6.65E-02	4.27E-01	SPECIMEN VOL(cm3)		8.84			
ACTIVITY OF SIMULATED WASTE INTEGRAL AREA PER GRAM				9.94E+04	5.60E+04		gram	area	ACTIVITY uCi/g AT		
USE FRACTION	0.85		T1/2(sec)	9.46E+08	1.58E+08	Cs-137	5.452	307905	3.11E-02	19/7/96/14.37	
OVERALL WASTE WEIGHT(g)=	5.11		Leach Rate (g.cm-2.d-1)			Co-60	5.452	911088	2.00E-01	19/7/96/14.37	
ACTUAL WASTE WEIGHT(g)=	4.36		Cs-137	Co-60			ml.	area	ACTIVITY uCi/g AT		
DIAMETER(cm)=	1.50		0.00032103	1.8625E-05		STD.Co-60	0.2	1052196	1.36E-01	10/5/96/10:00	
LENGTH(cm)=	5.00					STD.Cs-137	2	244545	1.35E-01	10/5/96/10:00	

INTERVAL			count/3000 sec		activity released		released fraction : F		Effective Diffusivity cm2/s		Leachability Index	
T:(HR)	TOTAL	DELTA	Cs-137	Co-60	Cs-137	Co-60	F(cs)=An/Ao	F(co)=An/Ao	Di(Cs)	Di(Co)	Li(Cs)	Li(Co)
2	7200	7200	5755	4443	5.84E-04	9.98E-04	8.79E-03	2.34E-03	8.96E-10	6.33E-11	9.05	10.20
7	25200	18000	8254	2299	8.38E-04	5.17E-04	2.14E-02	3.54E-03	7.00E-09	1.92E-10	8.15	9.72
24	86400	61200	16198	1033	1.64E-03	2.32E-04	4.61E-02	4.09E-03	9.72E-09	7.63E-11	8.01	10.12
49.4	177840	91440	18097	777	1.84E-03	1.75E-04	7.37E-02	4.49E-03	2.78E-08	1.03E-10	7.56	9.99
72	259200	81360	15571	1037	1.58E-03	2.33E-04	9.75E-02	5.04E-03	1.04E-07	2.78E-10	6.98	9.56
96	345600	86400	13982	214	1.42E-03	4.81E-05	1.19E-01	5.15E-03	1.90E-07	3.58E-10	6.72	9.45
120	432000	86400	10252	668	1.04E-03	1.50E-04	1.35E-01	5.50E-03	3.14E-07	5.26E-10	6.50	9.28
456	1641600	1209600	50381	18100	5.12E-03	4.09E-03	2.12E-01	1.51E-02	9.60E-09	4.88E-11	8.02	10.31
1128	4060800	2419200	61714	10749	6.28E-03	2.46E-03	3.06E-01	2.08E-02	1.45E-08	6.73E-11	7.84	10.17
2160	7776000	3715200	39585	658	4.04E-03	1.53E-04	3.67E-01	2.12E-02	1.88E-08	6.27E-11	7.73	10.20

ตาราง ผ.4-4 DATA FOR LEACH INDEX MEASUREMENT AND CALCULATION METHOD SHEET FOR 10% BORIC ACID WASTE FORMS

SAMPLE DESCRIPTION:	10.19	%boric waste	boric(g)	LDPE(g)			PI =	3.14		
DATE/MONTH/YEAR:	35252.00		0.51	4.4941	LEACHANT VOL(cm3)		223.93			
CALCULATED LEACH INDEX:	7.77	9.24	Cs activity	Co activity	SURFACE AREA(cm2)		22.39			
INITIAL ACTIVITY FROM USE FRACTION OF SIMULATED WASTE			0.03	0.03	SPECIMEN VOL(cm3)		7.07			
ACTIVITY OF SIMULATED WASTE INTEGRAL AREA PER GRAM			9.9E+04	5.6E+04		gram	area	ACTIVITY uCi/g AT		
USE FRACTION	1.00	T1/2(sec)	9.5E+08	1.6E+08	Cs-137	20	1988376	5.5E-02 3/6/96/10:00		
OVERALL WASTE WEIGHT(g)=	5.00				Co-60	20	1120843	5.7E-02 3/6/96/10:00		
ACTUAL WASTE WEIGHT(g)=	5.00					ml.	area	ACTIVITY uCi/g AT		
DIAMETER(cm)=	1.50				STD.Co-60	0.2	1052196	1.4E-01 10/5/96/10:00		
LENGTH(cm)=	4.00				STD.Cs-137	2	244545	1.4E-01 10/5/96/10:00		

Leach Rate (g.cm-2.d-1)	
Cs-137	Co-60
2.25E-05	5.00E-05

INTERVAL			count/3000 sec		activity released		released fraction : F		Effective Diffusivity cm2/s		Leachability Index	
T:(HR)	TOTAL	DELTA	Cs-137	Co-60	Cs-137	Co-60	F(cs)=An/Ao	F(co)=An/Ao	Di(Cs)	Di(Co)	Li(Cs)	Li(Co)
2	7200	7200	56896	2482	1.6E-03	1.3E-04	5.6E-02	4.5E-03	3.5E-08	2.2E-10	7.46	9.66
7	25200	18000	11876	3747	3.3E-04	1.9E-04	6.8E-02	1.1E-02	6.7E-08	1.8E-09	7.18	8.76
24	86400	61200	5407	621	1.5E-04	3.2E-05	7.3E-02	1.2E-02	2.3E-08	6.3E-10	7.64	9.20
48	172800	86400	3313	1200	9.2E-05	6.1E-05	7.7E-02	1.4E-02	3.1E-08	1.1E-09	7.51	8.97
72	259200	86400	4721	1157	1.3E-04	5.9E-05	8.1E-02	1.6E-02	5.9E-08	2.4E-09	7.23	8.62
96	345600	86400	2322	538	6.4E-05	2.7E-05	8.4E-02	1.7E-02	8.8E-08	3.7E-09	7.05	8.43
120	432000	86400	639	988	1.8E-05	5.0E-05	8.4E-02	1.9E-02	1.2E-07	5.8E-09	6.94	8.23
456	1641600	1209600	2238	427	6.2E-05	2.2E-05	8.7E-02	2.0E-02	1.5E-09	7.8E-11	8.82	10.11
1104	3974400	2332800	886	404	2.5E-05	2.1E-05	8.7E-02	2.0E-02	1.2E-09	6.4E-11	8.93	10.19
2136	7689600	3715200	517	972	1.4E-05	5.1E-05	8.8E-02	2.2E-02	1.0E-09	6.3E-11	9.00	10.20

ตาราง ผ.4-5 DATA FOR LEACH INDEX MEASUREMENT AND CALCULATION METHOD SHEET FOR 30% BORIC ACID WASTE FORMS

SAMPLE DESCRIPTION:	**30.14**	**%boric waste**		boric(g)	LDPE(g)	PI =	3.14				
DATE/MONTH/YEAR:	35252.00			1.5114	3.50266	**LEACHANT VOL(cm3)**	223.93				
CALCULATED LEACH INDEX:	**7.58**	**8.09**		Cs activity	Co activity	**SURFACE AREA(cm2)**	22.39				
INITIAL ACTIVITY FROM USE FRACTION OF SIMULATED WASTE				8.29E-02	8.56E-02	**SPECIMEN VOL(cm3)**	7.07				
ACTIVITY OF SIMULATED WASTE INTEGRAL AREA PER GRAM				9.94E+04	5.60E+04			gram	area	ACTIVITY uCi/g	AT
USE FRACTION	1.00		T1/2(sec)	9.46E+08	1.58E+08	Cs-137		20	1988376	5.50E-02	3/6/96/10:00
OVERALL WASTE WEIGHT(g)=	5.01		**Leach Rate (g.cm-2.d-1)**			Co-60		20	1120843	5.68E-02	3/6/96/10:00
ACTUAL WASTE WEIGHT(g)=	5.00		**Cs-137**	**Co-60**				ml.	area	ACTIVITY uCi/g	AT
DIAMETER(cm)=	1.50		**9.33E-05**	**1.27E-04**		STD.Co-60		0.2	1052196	1.36E-01	10/5/96/10:00
LENGTH(cm)=	4.00					STD.Cs-137		2	244545	1.35E-01	10/5/96/10:00

INTERVAL			count/3000 sec		activity released		released fraction : F		Effective Diffusivity cm2/s		Leachability Index	
T:(HR)	TOTAL	DELTA	Cs-137	Co-60	Cs-137	Co-60	F(cs)=An/Ao	F(co)=An/Ao	Di(Cs)	Di(Co)	Li(Cs)	Li(Co)
2	7200	7200	137963	30509	3.82E-03	1.55E-03	4.60E-02	1.81E-02	2.31E-08	3.56E-09	7.64	8.45
7	25200	18000	76248	29448	2.11E-03	1.50E-03	7.15E-02	3.56E-02	7.34E-08	1.81E-08	7.13	7.74
24	86400	61200	67996	28740	1.88E-03	1.46E-03	9.42E-02	5.26E-02	3.80E-08	1.19E-08	7.42	7.93
48	172800	86400	29877	13522	8.26E-04	6.87E-04	1.04E-01	6.06E-02	5.74E-08	1.94E-08	7.24	7.71
72	259200	86400	13059	5546	3.61E-04	2.82E-04	1.09E-01	6.39E-02	1.06E-07	3.67E-08	6.98	7.44
96	345600	86400	10119	2855	2.80E-04	1.45E-04	1.12E-01	6.56E-02	1.58E-07	5.44E-08	6.80	7.26
120	432000	86400	7118	2044	1.97E-04	1.04E-04	1.14E-01	6.68E-02	2.13E-07	7.27E-08	6.67	7.14
456	1641600	1209600	15868	5360	4.39E-04	2.74E-04	1.20E-01	7.00E-02	2.88E-09	9.87E-10	8.54	9.01
1104	3974400	2332800	5792	3098	1.61E-04	1.60E-04	1.22E-01	7.19E-02	2.28E-09	7.98E-10	8.64	9.10
2136	7689600	3715200	5458	569	1.52E-04	2.99E-05	1.23E-01	7.22E-02	1.96E-09	6.73E-10	8.71	9.17

ตาราง ผ.4-6 DATA FOR LEACH INDEX MEASUREMENT AND CALCULATION METHOD SHEET FOR 50% BORIC ACID WASTE FORMS

SAMPLE DESCRIPTION:	51.01	%boric waste	boric(g)	LDPE(g)	PI =	3.14				
DATE/MONTH/YEAR:	35252.00		2.609	2.506	LEACHANT VOL(cm3)	129.64				
CALCULATED LEACH INDEX:	6.98	7.74	Cs activity	Co activity	SURFACE AREA(cm2)	12.96				
INITIAL ACTIVITY FROM USE FRACTION OF SIMULATED WASTE			7.01E-02	7.24E-02	SPECIMEN VOL(cm3)	3.54				
ACTIVITY OF SIMULATED WASTE INTEGRAL AREA PER GRAM			9.94E+04	5.60E+04			gram	area	ACTIVITY uCi/g AT	
USE FRACTION	0.49	T1/2(sec)	9.46E+08	1.58E+08	Cs-137		20	1988376	5.50E-02	3/6/96/10:00
OVERALL WASTE WEIGHT(g)=	5.12				Co-60		20	1120843	5.68E-02	3/6/96/10:00
ACTUAL WASTE WEIGHT(g)=	2.50						ml.	area	ACTIVITY uCi/g AT	
DIAMETER(cm)=	1.50				STD.Co-60		0.2	1052196	1.36E-01	10/5/96/10:00
LENGTH(cm)=	2.00				STD.Cs-137		2	244545	1.35E-01	10/5/96/10:00

Leach Rate (g.cm-2.d-1)	
Cs-137	Co-60
2.82E-04	1.15E-04

INTERVAL			count/3000 sec		activity released		released fraction : F		Effective Diffusivity cm2/s		Leachability Index	
T:(HR)	TOTAL	DELTA	Cs-137	Co-60	Cs-137	Co-60	F(cs)=An/Ao	F(co)=An/Ao	Di(Cs)	Di(Co)	Li(Cs)	Li(Co)
2	7200	7200	327490	66918	9.06E-03	3.40E-03	1.29E-01	4.69E-02	1.35E-07	1.79E-08	6.87	7.75
7	25200	18000	157136	43891	4.35E-03	2.23E-03	1.91E-01	7.77E-02	3.91E-07	6.46E-08	6.41	7.19
24	86400	61200	99784	33110	2.76E-03	1.68E-03	2.31E-01	1.01E-01	1.70E-07	3.25E-08	6.77	7.49
48	172800	86400	27022	3838	7.48E-04	1.95E-04	2.41E-01	1.04E-01	2.29E-07	4.23E-08	6.64	7.37
72	259200	86400	9416	978	2.61E-04	4.97E-05	2.45E-01	1.04E-01	4.02E-07	7.28E-08	6.40	7.14
96	345600	86400	7611	339	2.11E-04	1.72E-05	2.48E-01	1.04E-01	5.79E-07	1.03E-07	6.24	6.99
120	432000	86400	4242	389	1.17E-04	1.98E-05	2.50E-01	1.05E-01	7.56E-07	1.33E-07	6.12	6.88
456	1641600	1209600	10280	1152	2.85E-04	5.89E-05	2.54E-01	1.06E-01	9.66E-09	1.67E-09	8.02	8.78
1104	3974400	2332800	1567	1517	4.35E-05	7.83E-05	2.54E-01	1.07E-01	7.45E-09	1.31E-09	8.13	8.88
2136	7689600	3715200	2141	2001	5.95E-05	1.05E-04	2.55E-01	1.08E-01	6.26E-09	1.12E-09	8.20	8.95

ตาราง ผ.4-7 DATA FOR LEACH INDEX MEASUREMENT AND CALCULATION METHOD SHEET FOR 10% SODIUM SULPHATE WASTE FORMS

SAMPLE DESCRIPTION:	10.25	%Na2SO4 waste	Na2SO4(g)	LDPE(g)	PI =	3.14				
DATE/MONTH/YEAR:	18/06/1996		0.51466	4.50413	LEACHANT VOL(cm3)	184.80				
CALCULATED LEACH INDEX:	8.04	8.45	Cs activity	Co activity	SURFACE AREA(cm2)	18.48				
INITIAL ACTIVITY FROM USE FRACTION OF SIMULATED WASTE			4.81E-03	2.47E-02	SPECIMEN VOL(cm3)	5.39				
ACTIVITY OF SIMULATED WASTE INTEGRAL AREA PER GRAM			9.94E+04	5.60E+04		gram	area	ACTIVITY uCi/g AT		
USE FRACTION	0.68	T1/2(sec)	9.46E+08	1.58E+08	Cs-137	20	1121627	1.37E-02	3/6/96/10:00	
OVERALL WASTE WEIGHT(g)=	6.76	Leach Rate (g.cm-2.d-1)			Co-60	20	641173	7.07E-02	3/6/96/10:00	
ACTUAL WASTE WEIGHT(g)=	4.59	Cs-137	Co-60			ml.	area	ACTIVITY uCi/g AT		
DIAMETER(cm)=	1.40	3.19E-05	1.86E-04		STD.Co-60	0.2	1052196	1.36E-01	10/5/96/10:00	
LENGTH(cm)=	3.50				STD.Cs-137	2	276357	1.35E-01	10/5/96/10:00	

INTERVAL			count/3000 sec		activity released		released fraction : F		Effective Diffusivity cm2/s		Leachability Index	
T:(HR)	TOTAL	DELTA	Cs-137	Co-60	Cs-137	Co-60	F(cs)=An/Ao	F(co)=An/Ao	Di(Cs)	Di(Co)	Li(Cs)	Li(Co)
2	7200	7200	10735	4563	1.31E-04	5.00E-04	2.73E-02	2.02E-02	6.94E-09	3.80E-09	8.16	8.42
7	21600	18000	4081	299	5.00E-05	3.28E-05	3.77E-02	2.16E-02	1.58E-08	5.15E-09	7.80	8.29
24	86400	61200	934	77	1.14E-05	8.43E-06	4.01E-02	2.19E-02	5.58E-09	1.66E-09	8.25	8.78
48	172800	86400	174	50	2.13E-06	5.48E-06	4.06E-02	2.21E-02	7.42E-09	2.21E-09	8.13	8.66
72	259200	86400	482	50	5.90E-06	5.47E-06	4.18E-02	2.23E-02	1.34E-08	3.82E-09	7.87	8.42
96	345600	86400	8882	4506	1.09E-04	4.93E-04	6.44E-02	4.23E-02	4.47E-08	1.93E-08	7.35	7.72
120	432000	86400	471	50	5.76E-06	5.47E-06	6.56E-02	4.25E-02	5.97E-08	2.51E-08	7.22	7.60
456	1641600	1209600	32246	12115	3.94E-04	1.32E-03	1.48E-01	9.58E-02	3.74E-09	1.58E-09	8.43	8.80
1128	4147200	2419200	21	767	2.56E-07	8.26E-05	1.48E-01	9.92E-02	2.74E-09	1.24E-09	8.56	8.91
2160	7772100	3715200	1572	401	1.91E-05	4.25E-05	1.52E-01	1.01E-01	2.59E-09	1.15E-09	8.59	8.94

ตาราง ผ.4-8 DATA FOR LEACH INDEX MEASUREMENT AND CALCULATION METHOD SHEET FOR 30% SODIUM SULPHATE WASTE FORMS

SAMPLE DESCRIPTION:	**30.10**	**%Na2SO4 waste**		Na2SO4(g)	LDPE(g)	PI =	3.14				
DATE/MONTH/YEAR:	18/06/1996			1.51608	3.52144	**LEACHANT VOL(cm3)**	228.80				
CALCULATED LEACH INDEX:	**5.82**	**6.11**		Cs activity	Co activity	**SURFACE AREA(cm2)**	22.88				
INITIAL ACTIVITY FROM USE FRACTION OF SIMULATED WASTE				2.08E-02	3.13E-02	**SPECIMEN VOL(cm2)**	6.93				
ACTIVITY OF SIMULATED WASTE INTEGRAL AREA PER GRAM				9.94E+04	5.60E+04		gram	area	ACTIVITY uCi/g AT		
USE FRACTION	1.00		T1/2(sec)	9.46E+08	1.58E+08	Cs-137	20	1121627	1.37E-02	3/6/96/10:00	
OVERALL WASTE WEIGHT(g)=	5.90		**Leach Rate (g.cm-2.d-1)**			Co-60	20	641173	2.07E-02	3/6/96/10:00	
ACTUAL WASTE WEIGHT(g)=	5.90		**Cs-137**	**Co-60**			ml.	area	ACTIVITY uCi/g AT		
DIAMETER(cm)=	1.40		**6.32E-04**	**1.12E-03**		STD.Co-60	0.2	1052196	1.36E-01	10/5/96/10:00	
LENGTH(cm)=	4.50					STD.Cs-137	2	276357	1.35E-01	10/5/96/10:00	

INTERVAL			count/3000 sec		activity released		released fraction : F		Effective Diffusivity cm2/s		Leachability Index	
T:(HR)	TOTAL	DELTA	Cs-137	Co-60	Cs-137	Co-60	F(cs)=An/Ao	F(co)=An/Ao	Di(Cs)	Di(Co)	Li(Cs)	Li(Co)
2	7200	7200	855124	326944	1.05E-02	1.05E-02	5.02E-01	3.34E-01	2.53E-06	1.12E-06	5.60	5.95
7	21600	18000	254657	100602	3.12E-03	3.22E-03	6.52E-01	4.37E-01	5.08E-06	2.29E-06	5.29	5.64
24	86400	61200	222154	106458	2.72E-03	3.41E-03	7.83E-01	5.46E-01	2.29E-06	1.12E-06	5.64	5.95
48	172800	86400	59633	31464	7.30E-04	1.01E-03	8.18E-01	5.78E-01	3.25E-06	1.63E-06	5.49	5.79
72	259200	86400	26570	14270	3.25E-04	4.57E-04	8.33E-01	5.93E-01	5.73E-06	2.90E-06	5.24	5.54
96	345600	86400	10221	4802	1.25E-04	1.54E-04	8.39E-01	5.98E-01	8.18E-06	4.15E-06	5.09	5.38
120	432000	86400	7078	34880	8.66E-05	1.12E-03	8.43E-01	6.33E-01	1.06E-05	6.01E-06	4.97	5.22
456	1641600	1209600	22239	11754	2.72E-04	3.74E-04	8.56E-01	6.45E-01	1.36E-07	7.71E-08	6.87	7.11
1128	4147200	2419200	1864	8707	2.27E-05	2.74E-04	8.58E-01	6.54E-01	9.97E-08	5.80E-08	7.00	7.24
2160	7772100	3715200	764	314	9.30E-06	9.73E-06	8.58E-01	6.54E-01	8.95E-08	5.20E-08	7.05	7.28

ตาราง ผ.4-9 DATA FOR LEACH INDEX MEASUREMENT AND CALCULATION METHOD SHEET FOR 50% SODIUM SULPHATE WASTE FORMS

SAMPLE DESCRIPTION:	**49.97**	**%Na2SO4 waste**		Na2SO4(g)	LDPE(g)	PI =	3.14				
DATE/MONTH/YEAR:	18/06/1996			2.5183	2.52114	**LEACHANT VOL(cm3)**	228.80				
CALCULATED LEACH INDEX:	**5.74**	**5.97**		Cs activity	Co activity	**SURFACE AREA(cm2)**	22.88				
INITIAL ACTIVITY FROM USE FRACTION OF SIMULATED WASTE				3.46E-02	5.21E-02	**SPECIMEN VOL(cm3)**	6.93				
ACTIVITY OF SIMULATED WASTE INTEGRAL AREA PER GRAM				9.94E+04	5.60E+04		gram	area	ACTIVITY uCi/g AT		
USE FRACTION	1.00		T1/2(sec)	9.46E+08	1.58E+08	Cs-137	20	1121627	1.37E-02	3/6/96/10:00	
OVERALL WASTE WEIGHT(g)=	5.58		**Leach Rate (g.cm-2.d-1)**			Co-60	20	641173	2.07E-02	3/6/96/10:00	
ACTUAL WASTE WEIGHT(g)=	5.58		**Cs-137**	**Co-60**			ml.	area	ACTIVITY uCi/g AT		
DIAMETER(cm)=	1.40		**1.07E-03**	**8.28E-04**		STD.Co-60	0.2	1052196	1.36E-01	10/5/96/10:00	
LENGTH(cm)=	4.50					STD.Cs-137	2	276357	1.35E-01	10/5/96/10:00	

INTERVAL			count/3000 sec		activity released		released fraction : F		Effective Diffusivity cm2/s		Leachability Index	
T:(HR)	TOTAL	DELTA	Cs-137	Co-60	Cs-137	Co-60	F(cs)=An/Ao	F(co)=An/Ao	Di(Cs)	Di(Co)	Li(Cs)	Li(Co)
2	7200	7200	2126592	898966	2.60E-02	2.88E-02	7.52E-01	5.53E-01	5.66E-06	3.07E-06	5.25	5.51
7	21600	18000	221888	123149	2.72E-03	3.95E-03	8.31E-01	6.29E-01	8.25E-06	4.73E-06	5.08	5.32
24	86400	61200	106853	57454	1.31E-03	1.84E-03	8.68E-01	6.65E-01	2.82E-06	1.65E-06	5.55	5.78
48	172800	86400	15915	8511	1.95E-04	2.73E-04	8.74E-01	6.70E-01	3.71E-06	2.18E-06	5.43	5.66
72	259200	86400	5551	4305	6.79E-05	1.38E-04	8.76E-01	6.73E-01	6.34E-06	3.74E-06	5.20	5.43
96	345600	86400	1361	1491	1.67E-05	4.77E-05	8.76E-01	6.73E-01	8.93E-06	5.27E-06	5.05	5.28
120	432000	86400	1387	1476	1.70E-05	4.72E-05	8.77E-01	6.74E-01	1.15E-05	6.81E-06	4.94	5.17
456	1641600	1209600	2562	1952	3.13E-05	6.21E-05	8.78E-01	6.76E-01	1.43E-07	8.45E-08	6.85	7.07
1128	4147200	2419200	554	1221	6.76E-06	3.84E-05	8.78E-01	6.76E-01	1.05E-07	6.20E-08	6.98	7.21
2160	7772100	3715200	69	297	8.40E-07	9.20E-06	8.78E-01	6.76E-01	9.37E-08	5.56E-08	7.03	7.25

ตาราง ผ.4-10 DATA FOR LEACH INDEX MEASUREMENT AND CALCULATION METHOD SHEET FOR 10% SPENT RESIN WASTE FORMS

SAMPLE DESCRIPTION:	**10.16**	**%Resin waste**		Resin(g)	LDPE(g)	PI =	3.14			
DATE/MONTH/YEAR:	13/06/1996			0.51011	4.5104	**LEACHANT VOL(cm3)**	206.80			
CALCULATED LEACH INDEX:	**8.17**	**8.71**		Cs activity	Co activity	**SURFACE AREA(cm2)**	20.68			
INITIAL ACTIVITY FROM USE FRACTION OF SIMULATED WASTE				1.16E-02	1.64E-02	**SPECIMEN VOL(cm3)**	6.16			
ACTIVITY OF SIMULATED WASTE INTEGRAL AREA PER GRAM				9.94E+04	5.60E+04		gram	area	ACTIVITY uCi/g	AT
USE FRACTION	0.83		T1/2(sec)	9.46E+08	1.58E+08	CS	20	2231003	2.73E-02	3/6/96/10.00
OVERALL WASTE WEIGHT(g)=	5.02		**Leach Rate (g.cm-2.d-1)**			CO	20	1198151	3.86E-02	3/6/96/10.00
ACTUAL WASTE WEIGHT(g)=	4.17		**Cs-137**	**Co-60**			ml.	area	ACTIVITY uCi/g	AT
DIAMETER(cm)=	1.40		**2.03E-05**	**1.03E-04**		STD.CO	0.2	1052196	1.36E-01	10/5/96/10.00
LENGTH(cm)=	4.00					STD.CS	2	276357	1.35E-01	10/5/96/10.00

INTERVAL			count/3000 sec		activity released		released fraction : F		Effective Diffusivity cm2/s		Leachability Index	
T:(HR)	TOTAL	DELTA	Cs-137	Co-60	Cs-137	Co-60	F(cs)=An/Ao	F(co)=An/Ao	Di(Cs)	Di(Co)	Li(Cs)	Li(Co)
2	7200	7200	14098	3902	1.73E-04	1.25E-04	1.49E-02	7.65E-03	2.15E-09	5.67E-10	8.67	9.25
7	25200	18000	9232	2438	1.13E-04	7.83E-05	2.47E-02	1.24E-02	7.76E-09	1.97E-09	8.11	8.70
24	86400	61200	17422	5164	2.13E-04	1.66E-04	4.31E-02	2.26E-02	7.07E-09	1.94E-09	8.15	8.71
48	172800	86400	10674	3750	1.31E-04	1.20E-04	5.43E-02	2.99E-02	1.39E-08	4.21E-09	7.86	8.38
72	259200	86400	4576	1367	5.60E-05	4.39E-05	5.92E-02	3.26E-02	2.80E-08	8.48E-09	7.55	8.07
96	345600	86400	8819	1542	1.08E-04	4.94E-05	6.85E-02	3.56E-02	5.27E-08	1.42E-08	7.28	7.85
120	432000	86400	4185	808	5.12E-05	2.59E-05	7.29E-02	3.72E-02	7.70E-08	2.00E-08	7.11	7.70
456	1641600	1209600	10837	3583	1.33E-04	1.14E-04	8.44E-02	4.42E-02	1.27E-09	3.49E-10	8.89	9.46
1128	4060800	2419200	3906	2488	4.77E-05	7.85E-05	8.85E-02	4.90E-02	1.01E-09	3.10E-10	8.99	9.51
2160	7776000	3715200	526	1099	6.40E-06	3.41E-05	8.90E-02	5.10E-02	9.24E-10	3.04E-10	9.03	9.52

ตาราง ผ.4-11 DATA FOR LEACH INDEX MEASUREMENT AND CALCULATION METHOD SHEET FOR 30% SPENT RESIN WASTE FORMS

SAMPLE DESCRIPTION:	37.37	%Resin waste		Resin(g)	LDPE(g)	PI =	3.14			
DATE/MONTH/YEAR:	13/06/1996			1.49691	2.5088	**LEACHANT VOL(cm3)**	162.80			
CALCULATED LEACH INDEX:	7.53	8.31		Cs activity	Co activity	**SURFACE AREA(cm2)**	16.28			
INITIAL ACTIVITY FROM USE FRACTION OF SIMULATED WASTE				4.01E-02	5.67E-02	**SPECIMEN VOL(cm3)**	4.62			
ACTIVITY OF SIMULATED WASTE INTEGRAL AREA PER GRAM				9.94E+04	5.60E+04		gram	area	ACTIVITY uCi/g AT	
USE FRACTION	0.98		T1/2(sec)	9.46E+08	1.58E+08	CS	20	2231003	2.73E-02	3/6/96/10:00
OVERALL WASTE WEIGHT(g)=	4.20		**Leach Rate (g.cm-2.d-1)**			CO	20	1198151	3.86E-02	3/6/96/10:00
ACTUAL WASTE WEIGHT(g)=	4.12		**Cs-137**	**Co-60**			ml.	area	ACTIVITY uCi/g AT	
DIAMETER(cm)=	1.40		**1.79E-04**	**1.46E-04**		STD.CO	0.2	1052196	1.36E-01	10/5/96/10:0(
LENGTH(cm)=	3.00					STD.CS	2	276357	1.35E-01	10/5/96/10:0(

INTERVAL			count/3000 sec		activity released		released fraction : F		Effective Diffusivity cm2/s		Leachability Index	
T:(HR)	TOTAL	DELTA	Cs-137	Co-60	Cs-137	Co-60	F(cs)=An/Ao	F(co)=An/Ao	Di(Cs)	Di(Co)	Li(Cs)	Li(Co)
2	7200	7200	113152	22959	1.39E-03	7.37E-04	3.45E-02	1.30E-02	1.05E-08	1.49E-09	7.98	8.83
7	25200	18000	49277	1558	6.03E-04	5.00E-05	4.96E-02	1.39E-02	2.85E-08	2.24E-09	7.55	8.65
24	86400	61200	140069	27250	1.71E-03	8.75E-04	9.23E-02	2.93E-02	2.95E-08	2.98E-09	7.53	8.53
48	172800	86400	128254	35098	1.57E-03	1.13E-03	1.31E-01	4.92E-02	7.38E-08	1.03E-08	7.13	7.99
72	259200	86400	46986	23730	5.75E-04	7.61E-04	1.46E-01	6.26E-02	1.54E-07	2.84E-08	6.81	7.55
96	345600	86400	22931	13411	2.81E-04	4.30E-04	1.53E-01	7.02E-02	2.38E-07	5.02E-08	6.62	7.30
120	432000	86400	19910	10045	2.44E-04	3.22E-04	1.59E-01	7.59E-02	3.32E-07	7.56E-08	6.48	7.12
456	1641600	1209600	47108	13100	5.76E-04	4.18E-04	1.73E-01	8.32E-02	4.88E-09	1.13E-09	8.31	8.95
1128	4060800	2419200	10600	4835	1.29E-04	1.52E-04	1.76E-01	8.59E-02	3.66E-09	8.67E-10	8.44	9.06
2160	7776000	3715200	6065	1520	7.38E-05	4.72E-05	1.78E-01	8.68E-02	3.36E-09	7.96E-10	8.47	9.10

ตาราง ผ.4-12 DATA FOR LEACH INDEX MEASUREMENT AND CALCULATION METHOD SHEET FOR 50% SPENT RESIN WASTE FORMS

SAMPLE DESCRIPTION:	50.00	%Resin waste		Resin(g)	LDPE(g)	PI =	3.14			
DATE/MONTH/YEAR:	13/06/1996			3.5	3.49995	LEACHANT VOL(cm3)		206.80		
CALCULATED LEACH INDEX:	7.30	7.90		Cs activity	Co activity	SURFACE AREA(cm2)		20.68		
INITIAL ACTIVITY FROM USE FRACTION OF SIMULATED WASTE				7.52E-02	1.06E-01	SPECIMEN VOL(cm3)		6.16		
ACTIVITY OF SIMULATED WASTE INTEGRAL AREA PER GRAM				9.94E+04	5.60E+04		gram	area	ACTIVITY uCi/g AT	
USE FRACTION	0.79		T1/2(sec)	9.46E+08	1.58E+08	CS	20	2231003	2.73E-02	3/6/96/10:00
OVERALL WASTE WEIGHT(g)=	7.00		Leach Rate (g.cm-2.d-1)			CO	20	1198151	3.86E-02	3/6/96/10:00
ACTUAL WASTE WEIGHT(g)=	5.50		Cs-137	Co-60			ml.	area	ACTIVITY uCi/g AT	
DIAMETER(cm)=	1.40		3.27E-04	2.01E-04		STD.CO	0.2	1052196	1.36E-01	10/5/96/10:0(
LENGTH(cm)=	4.00					STD.CS	2	276357	1.35E-01	10/5/96/10:0(

INTERVAL			count/3000 sec		activity released		released fraction : F		Effective Diffusivity cm2/s		Leachability Index	
T:(HR)	TOTAL	DELTA	Cs-137	Co-60	Cs-137	Co-60	F(cs)=An/Ao	F(co)=An/Ao	Di(Cs)	Di(Co)	Li(Cs)	Li(Co)
2	7200	7200	165239	28546	2.02E-03	9.17E-04	2.69E-02	8.63E-03	7.01E-09	7.21E-10	8.15	9.14
7	25200	18000	179590	37824	2.20E-03	1.21E-03	5.62E-02	2.01E-02	4.03E-08	5.14E-09	7.39	8.29
24	86400	61200	438717	118809	5.37E-03	3.81E-03	1.28E-01	5.60E-02	6.21E-08	1.19E-08	7.21	7.92
48	172800	86400	368120	110203	4.51E-03	3.54E-03	1.88E-01	8.92E-02	1.65E-07	3.75E-08	6.78	7.43
72	259200	86400	114065	73693	1.40E-03	2.36E-03	2.06E-01	1.11E-01	3.39E-07	9.93E-08	6.47	7.00
96	345600	86400	21433	22540	2.62E-04	7.23E-04	2.10E-01	1.18E-01	4.94E-07	1.57E-07	6.31	6.80
120	432000	86400	15947	20247	1.95E-04	6.49E-04	2.12E-01	1.24E-01	6.52E-07	2.24E-07	6.19	6.65
456	1641600	1209600	29121	27214	3.56E-04	8.68E-04	2.17E-01	1.33E-01	8.43E-09	3.15E-09	8.07	8.50
1128	4060800	2419200	17711	9333	2.16E-04	2.94E-04	2.20E-01	1.35E-01	6.26E-09	2.37E-09	8.20	8.63
2160	7776000	3715200	9614	3058	1.17E-04	9.49E-05	2.21E-01	1.36E-01	5.71E-09	2.16E-09	8.24	8.66

ตาราง ผ.4-13 DATA FOR LEACH INDEX MEASUREMENT AND CALCULATION METHOD SHEET FOR 10% SLUDGE WASTE FORMS

SAMPLE DESCRIPTION:	**9.97**	**%Sludge waste**		Sludge(g)	LDPE(g)	PI =	3.14				
DATE/MONTH/YEAR:	13/06/1996			0.50244	4.5377	**LEACHANT VOL(cm3)**	162.80				
CALCULATED LEACH INDEX:	**8.89**	**8.00**		Cs activity	Co activity	**SURFACE AREA(cm2)**	16.28				
INITIAL ACTIVITY FROM USE FRACTION OF SIMULATED WASTE				1.24E-02	3.16E-02	**SPECIMEN VOL(cm3)**	4.62				
ACTIVITY OF SIMULATED WASTE INTEGRAL AREA PER GRAM				9.51E+04	2.26E+05		gram	area	ACTIVITY uCi/g AT		
USE FRACTION	0.53		T1/2(sec)	9.46E+08	1.58E+08	Cs-137	10	951324	4.65E-02	1/7/96/10:00	
OVERALL WASTE WEIGHT(g)=	6.71		**Leach Rate (g.cm-2.d-1)**			Co-60	10	2262365	1.18E-01	1/7/96/10:00	
ACTUAL WASTE WEIGHT(g)=	3.56		**Cs-137**	**Co-60**			ml.	area	ACTIVITY uCi/g AT		
DIAMETER(cm)=	1.40		**1.77E-05**	**4.36E-04**		STD.Co-60	0.2	1517128	1.36E-01	10/5/96/10:00	
LENGTH(cm)=	3.00					STD.Cs-137	2	276357	1.35E-01	10/5/96/10:00	

INTERVAL			count/3000 sec		activity released		released fraction : F		Effective Diffusivity cm2/s		Leachability Index	
T:(HR)	TOTAL	DELTA	Cs-137	Co-60	Cs-137	Co-60	F(cs)=An/Ao	F(co)=An/Ao	Di(Cs)	Di(Co)	Li(Cs)	Li(Co)
2	7200	7200	988	10633	4.83E-05	5.56E-04	3.89E-03	1.76E-02	1.33E-10	2.73E-09	9.88	8.56
7	25200	18000	846	4152	4.13E-05	2.17E-04	7.22E-03	2.45E-02	6.05E-10	6.95E-09	9.22	8.16
24	86400	61200	1200	7032	5.86E-05	3.68E-04	1.20E-02	3.61E-02	4.94E-10	4.52E-09	9.31	8.34
48	172800	86400	914	1992	4.47E-05	1.04E-04	1.56E-02	3.94E-02	1.03E-09	6.64E-09	8.99	8.18
72	259200	86400	697	1563	3.41E-05	8.19E-05	1.83E-02	4.20E-02	2.43E-09	1.28E-08	8.61	7.89
96	345600	86400	673	1046	3.29E-05	5.48E-05	2.09E-02	4.38E-02	4.48E-09	1.96E-08	8.35	7.71
120	432000	86400	4541	32521	2.22E-04	1.71E-03	3.88E-02	9.78E-02	1.98E-08	1.26E-07	7.70	6.90
455	1638000	1206000	13694	90697	6.70E-04	4.78E-03	9.28E-02	2.49E-01	1.41E-09	1.01E-08	8.85	7.99
1128	4060800	2422800	984	8547	4.82E-05	4.55E-04	9.67E-02	2.64E-01	1.10E-09	8.13E-09	8.96	8.09
2160	7776000	3715200	155	800	7.61E-06	4.32E-05	9.74E-02	2.65E-01	1.00E-09	7.43E-09	9.00	8.13

ตาราง ผ.4-14 DATA FOR LEACH INDEX MEASUREMENT AND CALCULATION METHOD SHEET FOR 30% SLUDGE WASTE FORMS

SAMPLE DESCRIPTION: **29.93 %Sludge waste** Sludge(g) LDPE(g) PI = 3.14

DATE/MONTH/YEAR: 13/06/1996 1.51 3.52 **LEACHANT VOL(cm3)** 206.80

CALCULATED LEACH INDEX: **8.66** **7.75** Cs activity Co activity **SURFACE AREA(cm2)** 20.68

INITIAL ACTIVITY FROM USE FRACTION OF SIMULATED WASTE 4.96E-02 1.26E-01 **SPECIMEN VOL(cm3)** 6.16

ACTIVITY OF SIMULATED WASTE INTEGRAL AREA PER GRAM 9.51E+04 2.26E+05

USE FRACTION 0.71 T1/2(sec) 9.46E+08 1.58E+08

OVERALL WASTE WEIGHT(g)= 8.57

ACTUAL WASTE WEIGHT(g)= 6.08

DIAMETER(cm)= 1.40

LENGTH(cm)= 4.00

Leach Rate (g.cm-2.d-1)	
Cs-137	**Co-60**
1.01E-04	**5.27E-04**

	gram	area	ACTIVITY uCi/g AT
Cs-137	10	951324	0.04647326 1/7/96/10:00
Co-60	10	2262365	0.11831633 1/7/96/10:00
	ml.	**area**	**ACTIVITY uCi/g AT**
STD.Co-60	0.2	1517128	0.13569 10/5/96/10:00
STD.Cs-137	2	276357	0.13544 10/5/96/10:00

INTERVAL			count/3000 sec		activity released		released fraction : F		Effective Diffusivity cm2/s		Leachability Index	
T:(HR)	TOTAL	DELTA	Cs-137	Co-60	Cs-137	Co-60	F(cs)=An/Ao	F(co)=An/Ao	Di(Cs)	Di(Co)	Li(Cs)	Li(Co)
2	7200	7200	3690	31975	1.80E-04	1.67E-03	3.63E-03	1.32E-02	1.28E-10	1.70E-09	9.89	8.77
7	25200	18000	7097	48225	3.47E-04	2.52E-03	1.06E-02	3.32E-02	1.44E-09	1.41E-08	8.84	7.85
24	86400	61200	7261	51431	3.55E-04	2.69E-03	1.78E-02	5.45E-02	1.20E-09	1.13E-08	8.92	7.95
48	172800	86400	4881	33181	2.39E-04	1.74E-03	2.26E-02	6.83E-02	2.40E-09	2.19E-08	8.62	7.66
72	259200	86400	3303	24073	1.61E-04	1.26E-03	2.58E-02	7.83E-02	5.33E-09	4.89E-08	8.27	7.31
96	345600	86400	3108	23889	1.52E-04	1.25E-03	2.89E-02	8.82E-02	9.38E-09	8.74E-08	8.03	7.06
120	432000	86400	2303	13903	1.13E-04	7.29E-04	3.12E-02	9.39E-02	1.41E-08	1.28E-07	7.85	6.89
455	1638000	1206000	35989	173670	1.76E-03	9.15E-03	6.66E-02	1.66E-01	7.99E-10	4.98E-09	9.10	8.30
1128	4060800	2422800	61212	299171	3.00E-03	1.59E-02	1.27E-01	2.92E-01	2.08E-09	1.10E-08	8.68	7.96
2160	7776000	3715200	49818	234592	2.45E-03	1.27E-02	1.76E-01	3.93E-01	3.63E-09	1.80E-08	8.44	7.75

ตาราง ผ.4-15 DATA FOR LEACH INDEX MEASUREMENT AND CALCULATION METHOD SHEET FOR 50% SLUDGE WASTE FORMS

SAMPLE DESCRIPTION:	**49.91 %Sludge waste**		Sludge(g)	LDPE(g)	PI =	3.14					
DATE/MONTH/YEAR:	13/06/1996		2.50091	2.5101	**LEACHANT VOL(cm3)**	223.93					
CALCULATED LEACH INDEX:	**8.61**	**7.74**	Cs activity	Co activity	**SURFACE AREA(cm2)**	22.39					
INITIAL ACTIVITY FROM USE FRACTION OF SIMULATED WASTE			7.59E-02	1.93E-01	**SPECIMEN VOL(cm3)**	7.07					
ACTIVITY OF SIMULATED WASTE INTEGRAL AREA PER GRAM			9.51E+04	2.26E+05		gram	area	ACTIVITY uCi/g AT			
USE FRACTION	0.65	T1/2(sec)	9.46E+08	1.58E+08	Cs-137	10	951324	4.65E-02	1/7/96/10:00		
OVERALL WASTE WEIGHT(g)=	8.32	**Leach Rate (g.cm-2.d-1)**			Co-60	10	2262365	1.18E-01	1/7/96/10:00		
ACTUAL WASTE WEIGHT(g)=	5.43	**Cs-137**	**Co-60**			ml.	area	ACTIVITY uCi/g AT			
DIAMETER(cm)=	1.50	**1.06E-04**	**2.37E-04**		STD.Co-60	0.2	1517128	1.36E-01	10/5/96/10:00		
LENGTH(cm)=	4.00				STD.Cs-137	2	276357	1.35E-01	10/5/96/10:00		

INTERVAL			count/3000 sec		activity released		released fraction : F		Effective Diffusivity cm2/s		Leachability Index	
T:(HR)	TOTAL	DELTA	Cs-137	Co-60	Cs-137	Co-60	F(cs)=An/Ao	F(co)=An/Ao	Di(Cs)	Di(Co)	Li(Cs)	Li(Co)
2	7200	7200	9939	69862	4.86E-04	3.65E-03	6.40E-03	1.89E-02	4.46E-10	3.89E-09	9.35	8.41
7	25200	18000	6167	45616	3.01E-04	2.39E-03	1.04E-02	3.13E-02	1.54E-09	1.40E-08	8.81	7.85
24	86400	61200	15491	95410	7.57E-04	4.99E-03	2.03E-02	5.71E-02	1.77E-09	1.40E-08	8.75	7.85
48	172800	86400	7862	52290	3.84E-04	2.74E-03	2.54E-02	7.13E-02	3.41E-09	2.69E-08	8.47	7.57
72	259200	86400	4301	31612	2.10E-04	1.66E-03	2.82E-02	7.99E-02	7.13E-09	5.73E-08	8.15	7.24
96	345600	86400	3630	26478	1.77E-04	1.39E-03	3.05E-02	8.71E-02	1.18E-08	9.57E-08	7.93	7.02
120	432000	86400	3604	19310	1.76E-04	1.01E-03	3.28E-02	9.23E-02	1.75E-08	1.39E-07	7.76	6.86
455	1638000	1206000	36090	175172	1.77E-03	9.23E-03	5.61E-02	1.40E-01	6.36E-10	3.97E-09	9.20	8.40
1128	4060800	2422800	42569	198473	2.09E-03	1.06E-02	8.36E-02	1.95E-01	1.01E-09	5.50E-09	8.99	8.26
2160	7776000	3715200	72271	344278	3.55E-03	1.86E-02	1.30E-01	2.91E-01	2.23E-09	1.11E-08	8.65	7.95

ประวัติผู้เขียน

นางสาวบุญฉวี ศรีหมอก เกิดเมื่อวันที่ 2 ธันวาคม พุทธศักราช 2515 ตรงกับวันแรม 12 ค่ำ เดือนสิบสอง ปีชวด ที่จังหวัดพระนครศรีอยุธยา จบการศึกษาระดับมัธยมศึกษาจาก โรงเรียนจอมสุรางค์อุปถัมภ์ จังหวัดพระนครศรีอยุธยา ในปีการศึกษา 2531สำเร็จการศึกษาระดับปริญญาตรีทางด้านวิทยาศาสตร์ สาขาวิชาเอกเคมีอุตสาหกรรม จากสถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหาร ลาดกระบัง ในปีการศึกษา 2535 จากนั้นได้ศึกษาต่อในระดับบัณฑิตศึกษาที่จุฬาลงกรณ์มหาวิทยาลัย สาขาวิชา นิวเคลียร์เทคโนโลยี ขณะที่ทำการศึกษาอยู่นั้นได้ดำรงตำแหน่งผู้ช่วยวิจัยและมีประสบการณ์ด้านการวัลคาไนซ์น้ำยางธรรมชาติด้วยรังสี