LX-10 GRANULATION AND HMX
DISTRIBUTION STUDY

A. A. Duncan

MASTER

DEVELOPMENT DIVISION

OCTOBER - DECEMBER 1975

Normal Process Development
Endeavor No. 105

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ABSTRACT

LX-10 HMX distributions were found not to be functions of LX-10 granulation size. Granulation sizes from 6 to 18 U.S. mesh were studied and found to have similar HMX distributions.

DISCUSSION

Two LX-10 lots (Pantex 5274-122-1 and Holston 711-1) were used to study the effects of granulation size on the formulated HMX distribution. U.S. mesh Nos. 6, 8, 10, 12, 14, 16 and 18 sieves were used to separate the granules into various sizes. These cuts were selected in order to provide a large range of granule sizes.

HMX distributions were studied for both the unsieved LX-10 and the above granulation fractions. HMX distributions were determined by sieve analysis of the extracted HMX. The sieve nest ranged from 10 to 180 μm . Extraction of the HMX from the LX-10 formulation was done by dissolving the Sylgard binder with isobutyl acetate. Tables I and II list weight percents for granulation distribution as well as the HMX distribution for the unsieved LX-10 and the various granulation fractions studied.

From these tables it can be seen that the various distributions were similar. The Neyman - Pearson L test⁽¹⁾ for variances show that all the distributions for a given lot when tested at the 0.01 level were not significantly different.

Also listed in Tables I and II are Kelly's Kurtosis and the Percentile Estimate. The Percentile Estimate is used to describe the central tendencies of a distribution between its lower and upper quartiles. Kelly's Kurtosis likewise is a ratio of the middle 50th percent range of the distribution to the 80th percent range of the distribution. This ratio is used to describe the distribution peak. Both the percentile estimate and Kelly's Kurtosis are also not significantly different for each distribution studied.

(1) F. E. Croxton and D. J. Crowden, "Applied General Statistics," p. 704 Prentice-Hall, New Jersey (1965).

Table I. HMX Particle Characterization of LX-10 Lot 5274-122-01

Sample Identification	Weight % Retained on Sieve Size (μ m)														Arithmetic Mean (μ m)	Standard Deviation	Lower Quartile (μ m)	Median (μ m)	Upper Quartile (μ m)	Kelly's* Kurtosis Flatness	Percentile** Estimate
	180	150	130	100	90	80	70	60	50	40	30	20	10	10							
As Formulated																					
5274-122-01	20.71	9.51	6.41	14.26	2.85	4.77	5.29	6.30	5.17	5.32	4.07	2.92	3.68	8.73	103.11	62.59	50.5	101.9	166.5	0.333	2.1300
After Formulation																					
Retained on 6	22.33	10.26	6.34	15.73	2.95	6.06	5.96	6.81	6.06	5.62	4.13	2.61	2.88	2.26	111.12	57.85	62.1	108.8	172.2	0.360	2.1281
Thru 6 on 8	20.55	9.72	5.70	14.70	2.29	5.08	5.44	6.12	5.13	5.18	3.98	2.86	3.79	9.46	102.31	63.00	49.5	101.4	165.3	0.331	2.1363
Thru 8 on 10	20.44	10.24	4.98	14.69	2.22	5.37	5.08	6.02	5.19	5.27	3.98	3.06	3.67	9.79	101.91	63.29	48.5	100.7	166.6	0.333	7.1849
Thru 10 on 12	20.56	9.86	4.91	14.24	2.56	5.33	5.34	6.11	5.20	5.27	4.15	3.06	3.86	9.55	101.51	63.25	48.3	98.3	166.4	0.335	2.1440
Thru 12 on 14	21.35	9.16	5.94	14.11	2.78	5.08	5.31	5.90	4.85	4.80	4.15	3.10	4.15	9.30	102.62	63.40	48.9	101.2	168.1	0.338	2.1376
Thru 14 on 16	21.74	9.67	5.55	15.09	2.29	5.18	5.25	6.42	5.13	4.92	3.96	2.92	3.56	8.31	104.64	62.59	52.5	104.1	166.9	0.338	2.1086
Thru 16 on 18	20.50	10.35	6.03	14.19	2.20	5.36	4.91	5.98	4.80	4.98	3.87	2.62	4.23	9.99	102.50	63.55	48.6	102.2	166.9	0.333	2.2250
Thru 18	21.09	10.65	5.13	14.44	2.57	5.29	6.13	5.31	4.85	5.42	4.05	2.61	3.86	8.59	104.07	62.78	51.0	102.7	169.0	0.339	2.1413

Granulation for LX-10

	Weight % Retained on U.S. Sieve Number							
	6	8	10	12	14	16	18	20
5274-122-01	0.55	17.42	15.63	21.87	18.22	6.89	15.89	3.54

$$*Kelly's \text{ Kurtosis} = (Q_{75} - Q_{25}) / (P_{90} - P_{10})$$

$$**Percentile \text{ Estimate} = \frac{Q_{75} + Q_{25}}{Q_{25}}$$

Table II. HMX Particle Characterization of LX-10 Lot 711-1

Sample Identification	180	150	130	100	Weight Retained	Sieve Size (μm)									Arithmetic Mean (μm)	Standard Deviation	Lower Quartile (μm)	Median (μm)	Upper Quartile (μm)	Kelly's* Kurtosis Flatness	Percentile** Estimate
					90	80	70	60	50	40	30	20	10	<10							
As Formulated																					
711-1	20.95	10.13	4.85	11.90	3.92	4.41	6.41	4.07	6.10	5.13	4.69	4.06	6.05	7.33	100.99	63.77	45.6	94.5	168.0	0.353	2.2611
After Formulation																					
Retained on 6	18.73	9.28	6.41	12.97	5.25	4.54	7.02	5.01	6.93	6.16	5.39	3.91	4.32	4.00	101.99	59.60	51.6	95.0	159.7	0.332	2.2243
Thru 6 on 8	20.08	9.49	5.38	11.83	4.06	4.12	6.20	4.03	6.21	5.21	4.68	3.77	6.90	8.05	98.85	63.97	43.1	92.1	164.5	0.347	2.2538
Thru 8 on 10	19.19	9.37	6.35	13.18	3.37	4.00	6.14	4.11	6.00	5.22	4.77	1.39	9.26	7.63	98.82	63.54	43.7	94.4	161.4	0.337	2.1736
Thru 10 on 12	19.82	9.37	5.60	11.80	4.02	4.37	6.15	4.06	6.17	5.35	4.77	2.04	8.37	8.12	98.45	63.97	43.2	91.5	163.4	0.343	2.2578
Thru 12 on 14	18.37	9.31	4.81	11.54	3.97	4.17	6.22	4.14	6.57	5.84	5.35	4.15	6.64	8.92	95.07	63.70	39.9	85.2	158.6	0.339	2.3302
Thru 14 on 16	18.84	8.85	5.80	12.46	4.04	4.39	6.12	4.24	6.31	5.44	4.91	3.33	8.22	6.99	97.38	63.02	42.8	90.0	159.1	0.336	2.2431
Thru 16 on 18	18.41	9.78	5.86	13.11	4.66	4.84	7.17	4.84	7.36	6.21	5.62	4.30	5.45	2.37	101.82	59.24	51.4	93.9	159.8	0.335	2.2489
Thru 18	23.06	10.85	5.72	12.56	4.56	3.91	7.33	3.64	6.19	5.26	5.14	3.44	4.74	3.59	108.43	61.34	54.6	105.2	174.6	0.367	2.1780

Granulation for LX-10

	Weight % Retained on U.S. Sieve Number							
	6	8	10	12	14	16	18	<18
711-1	2.19	17.07	11.87	21.98	16.20	4.42	12.85	13.41

$$*Kelly's\ Kurtosis = (Q_{75} - Q_{25}) / (P_{90} - P_{10})$$

$$**Percentile\ Estimate = \frac{Q_{75} + Q_{25}}{Q_{25}}$$