RJR

SECRET

INTEROFFICE MEMORANDUM No. 348 By

TO: L. H. O'Connor FROM: C. K. Banerjee

SUBJECT: Monthly Report DATE: November 12, 1985
October 1985

A. EFFECT OF STORAGE ON ALPHA COMPONENTS

A study to compare the effects of storage on the migration of humectants and adsorption of atmospheric moisture has been concluded. Both B3 and TEG were tested as humectants. Capsules were filled with known amounts of either alumina containing 36% B3/TEG, PG-60 containing 28% B3/TEG or DP-131 containing 43% B3/TEG. Capsules were fitted with 223 D7C fuel source (pre-equilibrated to ambient conditions) and stored in air-tight containers. The containers were opened only during sampling. Each group had ten replicates. Migration of humectants were monitored gravimetrically as well as by analysis of B3 in the samples. The units are described in Table 1. Results of the 30 day, 80 day and 116 day storage are presented in Tables 2 and 3.

TEST UNITS

G-Capsules filled with substrate and capped with 223 D7C fuel sources.

Fuel Source	223 D7C pre-equilibrated to ambient conditions.
Substrate	WRG-Alumina DP-131 PG-60
Humectant	TEG or B3

STORAGE CONDITIONS

Ambient temp + humidity

Stored in 2-oz. containers with air-tight glass lids

Containers opened only during sampling; i.e., on Day 30, Day 60 and Day 116.

Units stored with fuel source down

25-30 units stored per container

CONCLUSION

High standard deviation is due to variable substrate surface in contact with fuel source. A larger sample size would probably reduce the RSD.

Alumina with B3 gained the maximum in total weight. This gain in weight is supposedly due to adsorption of atmospheric moisture.

For the first thirty days, the adsorbed moisture was mainly localized on the alumina surface. Thereafter, the moisture/humectant moved to the fuel source. Probably, the adsorbed moisture reduces the surface energy of the glycerol and hence makes it more flowable on the alumina/carbon surface.

Units containing DP-131 showed a steady rise in total weight. Most of the adsorbed moisture stayed on the substrate.

PG-60 showed the minimum capacity to retain the humectant. In units with PG-60 as a substrate, total weight gain reached a maximum on day 30 and thereafter declined to 0.1 $\pm$ .08 on day 116. Probably, some of the moisture/humectant has been lost to the atmosphere via electrolysis (?).

With TEG as humectant, alumina showed a similar trend as above. In units with PG-60 or DP-131, TEG/moisture reached an equilibrium on day 30. Migration of TEG to FS was maximum in units with PG-60 as substrate.

B. RETENTION CAPACITY

About 30 more pairs of perforated cups and tubes have been machined by Tommy Ridings for use in the determination of retention capacities. This would enable us to analyze additional samples per run. Additional tubes will be needed for the Analytical Division. Art Milhous will place an order for the centrifuge and other equipment needed for this analysis. In the meantime, they will be using the centrifuge in the substrate lab.

C. Flowability of Substrates

Flowability of substrates is being tested in a device shown in Figure 1. The reservoir is filled with the test substance and with the help of an air-driven switch, the plate 'C' is moved back and forth 30 times. The number of times the test substance has successfully flowed through the tube without clogging or bridging is recorded. The procedure is replicated five times. Results of the analysis are presented in Tables 4, 5, 6 and 7.

CONCLUSION

The following treatments improved the flowability of substrate through the tube:

1. Irregular particles
2. Smaller spherical particles; -16+20 U.S. Mesh
3. Coating of substrates by powder

CK Banerjee

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Attachments

CKB:bwo

FLOW OF SUBSTRATE THROUGH A TUBE

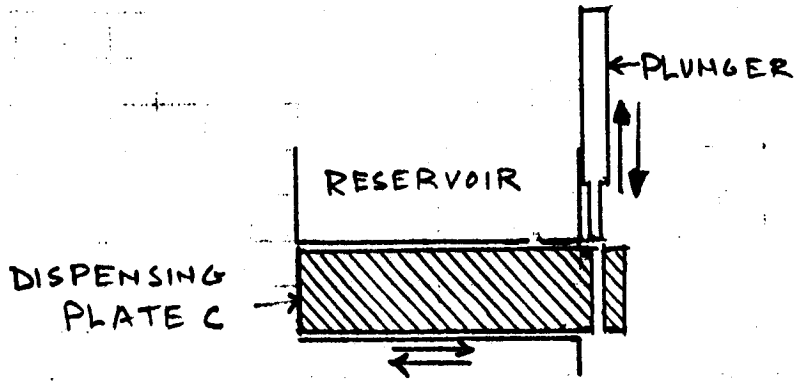

FIG. 1.

TABLE 1. DESCRIPTION OF UNITS

SUBSTRATE	AMT. PER CAP. mg,	LOADING %	HUM. PER CAP. mg
Alumina	235	36	84.6
DP-131	178	43	76.5
PG-60	254	28	71.1

TABLE 2. CHANGE IN WEIGHT (mg) OF ALPHA COMPONENTS; TEG AS HUMECTANT

Substrate	Substrate			Fuel Source			Total		
	30 Days	80 Days	116 Days	30 Days	80 Days	116 Days	30 Days	80 Days	116 Days
Alumina	+8.7±5.6	+4.0±2.7	+0.8±0.4	+1.5±1.0	+3.6±1.2	+0.8±0.6	+10.2±4.5	+8.2±1.7	+1.6±0.6
DP131	+6.3±1.5	+6.7±1.4	+4.8±1.9	-2.4±1.0	+0.1±1.2	+2.9±0.5	+3.9±2.0	+6.8±1.2	+7.7±1.1
PG-60	-40.4±5.4	-39.0±10.9	ND	+42.0±5.1	ND	ND	+1.6±2.9	ND	+2.8±2.8

TABLE 3. CHANGE IN WEIGHT (mg) OF ALPHA COMPONENTS; B-3 AS HUMECTANT

Substrate	Substrate			Fuel Source			Total		
	30 Days	80 Days	116 Days	30 Days	80 Days	116 Days	30 Days	80 Days	116 Days
Alumina	+9.2±2.0	+7.7±4.9	+0.2±5.1	+2.9±1.9	+10.0±3.4	+15.2±6.0	+12.1±2.7	+17.6±2.8	+15.5±1.9
DP-131	+3.2±2.2	+7.0±1.7	+7.0±1.8	+3.9±5.5	+2.5±1.8	+3.4±0.3	+7.1±6.1	+9.5±2.0	+10.4±2.0
PG-60	-3.8±2.3	-18.0±4.7	-26.9±7.2	+16.4±3.3	ND	+27.0±0.8	+12.6±2.9	ND	+0.1±0.8

TABLE 4
PRELIMINARY FLOW-ABILITY TEST

SUBSTRATE	LOADING		REPLICATES 1	2	3	4	5	COMMENTS
DP-131-Modified WRG-Alumina	None Spec		30 0	30 3	30 0	30 2	30 7	
WRG Alumina Unsintered								
+8 U.S. Mesh	None		14	5	8	3	19	
-8+10 U.S. Mesh	None		15	0	0	10	0	
WRG Sintered 1440°C								
-12+14 U.S.	None		2	0	3	0	0	
-14+16 U.S.	None		1	0	4	0	12	
-16+20 U.S.	None		30	30	30	30	30	
-16+20 U.S.	SD6X B-3 LA	10.7% 22.6% 0.7%	30	30	30	30	30	Sticky Needs Assistance
-16+20 U.S.	SD6X B-9 LA	10.7% 22.6% 0.7%	30	30	30	30	30	Sticky Needs Assistance
Crushed -12+16 U.S.	None		30	30	30	30	30	
Air-Products Alumina 31X50 mil	None		30	30	30	30		

TABLE 5
EFFECT OF POWDERS AS COATING MATERIAL

POWDER	CONC, %	LOADING	REPLICATES 1	2	3	4	5
G-7 -100+200	2	Spec Sub	30	30	30	30	30
G-7 -200+230	2	Spec Sub	30	30	30	30	30
Vermiculite	1	Spec Sub	30	30	30	30	30
Sd-6X	4	28% B3	30	30	30	30	30

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TABLE 6
EFFECT OF B-3 LOADING

TEST MATERIAL		REPLICATES 1	2	3	4	5
-10+14 WRG Alumina	79.3%	0	0	3	0	0
SD6X	10%					
B-3	10%					
LA	0.7%					
Same as above except B-3	15%	0	0	0	0	1
Same as above except B-3	20%	4	0	4	4	1

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TABLE 7
WEIGHTS (mg) OF SPEC SUBSTRATED
COATED WITH 2% G-7 (-100+230) DUST,
DELIVERED BY THE DEVICE

190.4	198.6	183.0	
176.5	169.0	180.3	170.4
183.0	172.1	174.5	189.5
157.4	174.5	186.5	175.4
148.5	187.6	172.4	186.5
173.6	188.0	184.4	

MEAN	178.24
SD	11.29
RSD	6.33%

TABLE 8
EFFECT OF SINTERING TEMP ON SUBSTRATE

SAMPLE	TEMP °C	CRUSH STRENGTH; K6	RC_{100}	RD_{1600}	SENSORY EVALUATIO
8010-1	1150	1.19 ± .35	47.7;	45.8	
8016-1	1350	1.18 ± .28	45.9;	44.1	
8013-1	1400	1.30 ± .37	44.9;	43.4	A+
8014-1	1440	1.31 ± .20	44.2;	42.2	A+
8018-1	1350 (Harrop)	2.25 ± .59	41.7;	40.2	A+

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