

GEORGIA INSTITUTE OF TECHNOLOGY
Engineering Experiment Station

PROJECT TERMINATION

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PROJECT DIRECTOR: W. H. Burrows

SPONSOR: Anderson BEC

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GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

April 5, 1973

Anderson-IBEC
19699 Progress Drive
Strongsville, Ohio 44136

Attention: Dr. Edward F. Wahl

Subject: Progress Report, Project A-1519
Studies on the Drying of Lactose Fermentate

Gentlemen:

This report provides operational data and results obtained in studies of the drying of "Wheast" lactose fermentate and of whey.

Eight runs were made using "Wheast" as feed material. Inasmuch as the air velocity through the rotary dryer was too great to permit appreciable residence time of the powdered material in the dryer, and losses to cyclone underflow and exhaust stack were too great, various attempts were made to pelletize the "Wheast" to produce a pellet of such size as to circumvent these losses. Starting with Run #7, the blower pulley diameter was increased to 10 inches to reduce the air velocity and provide greater dryer retention times for the product. Operating parameters of the rotary dryer and auxiliary equipment in these studies are described in Table 1. References are given to page numbers in the laboratory notebook; copies of these pages will be provided, if desired.

During the Wheast runs, samples of feed, dryer discharge and cone underflow were taken at time intervals indicated in the data points of Table 1. Moisture determinations were made on these samples, and the percent moisture was utilized to reduce weight distributions to the dry basis. Results of these determinations, together with dry weights of material at feed, dryer discharge and cone discharge points, are shown in Table 2.

Six studies of a similar nature were made utilizing a dehydrated whey. In all of the whey studies, the blower was operated on a 10-inch diameter pulley in order to maintain a sufficiently low air velocity to provide adequate residence time of the product in the rotary dryer.

Operating parameters of the dryer for the whey studies are shown in Table 3, together with moisture and weight results obtained in these runs.

Respectfully submitted,

W. H. Burrows
Materials and Chemical Technology
Laboratory

3. Run No. 3 (Continued)

Time: 15 min.

Dryer Discharge Temperature: 150°F

Dryer Discharge Product Temp: 106°F

4. Run No. 4 Reference Page 10

Feed: Wheast mixed with water to 20% moisture, allowed to mix in concrete mixer overnight.

Burner: On, at lowest setting

Feed Rate: 30 lb/10 min. (by hand)

Exhaust Fan Pulley Diameter: 6" Air Velocity: 120 ft/min.

Data Point 1

Time: 15 min.

Dryer Discharge Temp.: 156°F

Dryer Discharge Product Temp.: 98°F

5. Run No. 5 Reference Page 11

Feed: Wheast fed to 3d. story bin and from these, through the Omega feeder to the pelletizer. After the material was heated and wetted and pelletized, it was fed to the dryer.

Burner: On, at low setting.

Exhaust Fan Pulley: 6" Air Velocity: 120 ft/min.

Feed Rate: 35 lb/10 min. of moist material.

Omega feeder set at: Gate @ 5
Weight @ 3
Wheel @ 500

Pelletized feed to dryer was at 130-150°F and 20-25% moisture

Other Parameters: Optimum conditions for pelletized product were:

water to pelletizer: 35% of rotameter scale

steam to pelletizer: 3/4 turn open steam valve

Temperature of Dryer Discharge: 152°F

5. Run No. 5 (Continued)

Dryer Discharge Product Temp.: 104°F

Note: No data points taken in this run. The dryer discharge product was received in a Sweco screening apparatus with a 11 mesh and a 20 mesh screen that produced three products:

"coarse": +11 mesh
"medium": 11 x 20 mesh
"fine": -20 mesh

The screens were used in all remaining wheat runs.

6. Run No. 6 Reference Pages 13, 14, 15, 26, 27, 28, 29

Feed: Pelletized wheat @ moisture of ± 27% and temp. 136°F

Burner: On, at low setting

Exhaust Fan Pulley Diameter: 6" Air Velocity: 120 ft/min.

Feed Rate: 35 lb/10 min of pellets to dryer. (See Run 5 for Omega feeder set).

Pelletizer: Water @ 35% of Rotameter scale; Steam: 3/4 open valve.

Residence Time: 10 minutes

Dryer Slope: "Normal" = 7/12"/ft

Data Point 1

Time: 10 minutes

Dryer Discharge Temp.: 154°F

Dryer Discharge Product Temp.: 106°F

Data Point 2

Time: 10 minutes

Pelletized Feed Temperature: 135°F

Dryer Discharge Temp.: 149°F

Dryer Discharge Product Temp.: 104°F

Data Point 3

Time: 10 minutes

Pelletized Feed Temperature: 135°F

Dryer Discharge Temperature: 158°F

Dryer Discharge Product Temperature: 104°F

Data Point 4

Time: 10 minutes

Pelletized Feed Temperature: 136°F

Dryer Discharge Temperature: 153°F

Dryer Discharge Product Temperature: 116°F

Pelletizer: Water @ 35% of Rotameter.
Steam @ 3/4 of valve setting open.

Dryer Slope: Normal (7/12"/ft)

Data Point 1

Time: 10 minutes

Pelletizer: Steam: 3/4 valve open
Water @ 35% Rotameter with nebulizer
Temperature Pelletized Feed: 138°F

Dryer Discharge Temperature: 160°F

Dryer Discharge Product Temperature: 115°F

Data Point 2

Time: 10 minutes

Pelletizer: Steam: 3/4 valve open
Water @ 35% Rotameter, with nebulizer
Temperature Pelletized Feed: 138°F

Dryer Discharge Temperature: 185°F

Dryer Discharge Product Temperature: 126°F

Data Point 3

Time: 10 minutes

Pelletizer: Steam: 3/4 valve open
Water @ 35% Rotameter, using the existing water pipe in
pelletizer

Dryer Discharge Temperature: 180°F

Dryer Discharge Product Temperature: 116°F

TABLE 2
MOISTURE AND WEIGHT DATA
Wheat Studies

1.	<u>Run 1, Data Point 1</u>		
	<u>Product</u>	<u>% Moisture</u>	<u>Dry Weight, lb.</u>
	Feed	5.2	21.6
	Dryer Discharge	4.0	13.3
	Cone Underflow	4.6	10.1
	<u>Data Point 2</u>		
	Feed	5.2	
	Dryer Discharge	4.6	
	Cone Underflow	4.4	
2.	<u>Run 2, Data Point 1</u>		
	Feed	5.2	21.6
	Dryer Discharge	3.8	5.17
	Cone Underflow	-0-	-0-
3.	<u>Run 3, Data Point 1</u>		
	Feed	23.0	34.7
	Dryer Discharge	11.4	14.0
	Cone Underflow	2.0	5.9
	<u>Data Point 2</u>		
	Feed	23.0	34.7
	Dryer Discharge	6.8	24.3
	Cone Underflow	2.6	7.0
4.	<u>Run 4, Data Point 1</u>		
	Feed	18.8	36.5
	Dryer Discharge	5.7	20.3
	Cone Underflow	2.2	4.5
5.	<u>Run 5</u> --No weight data taken.		

6. Run 6, Data Point 1

Product	% Moisture	Dry Wt. lb.	% Wt. of Dryer Discharge
Feed	26.0	25.9	--
Dryer Discharge Coarse +11	19.4	7.7	47.0
Dryer Discharge Medium 11 x 20	9.0	1.5	9.1
Dryer Discharge Fine -20	8.2	7.2	43.9
Cone Underflow	4.6	1.2	--

Data Point 2

Feed	25.4	26.1	--
Dryer Discharge Coarse	19.8	8.1	41.7
Dryer Discharge Medium	9.2	1.7	8.8
Dryer Discharge Fine	7.8	9.6	49.5
Cone Underflow	5.0	1.3	--

Data Point 3

Feed	25.0	26.3	--
Dryer Discharge Coarse	17.8	10.0	39.8
Dryer Discharge Medium	8.6	2.1	8.4
Dryer Discharge Fine	7.4	13.0	51.8
Cone Underflow	3.8	2.3	--

Data Point 4

Feed	30.8	24.2	--
Dryer Discharge Coarse	17.0	8.4	37.3
Dryer Discharge Medium	7.0	2.3	10.2
Dryer Discharge Fine	6.0	11.8	52.5
Cone Underflow	4.8	2.3	--

7. Run 7, Data Point 1

Feed	14.6	30.0	--
Dryer Discharge Coarse	5.6	0.8	4.9
Dryer Discharge Medium	2.4	0.6	3.7
Dryer Discharge Fine	2.4	15.0	91.4
Cone Underflow	1.4	6.0	--

7. Run 7, Data Point 2

<u>Product</u>	<u>% Moisture</u>	<u>Dry Wt. lb.</u>	<u>% Wt. lb. Dryer Discharge</u>
Feed	9.4	31.7	--
Dryer Discharge Coarse	6.6	0.4	1.8
Dryer Discharge Medium	0.8	0.4	1.8
Dryer Discharge Fine	0.8	21.3	96.4
Cone Underflow	0.8	6.8	--

Data Point 3

Feed	9.0	31.9	--
Dryer Discharge Coarse	6.0	0.1	0.6
Dryer Discharge Medium	1.0	0.1	0.6
Dryer Discharge Fine	1.0	17.2	98.8
Cone Underflow	0.0	5.6	--

8. Run 8, Data Point 1

Feed	27.4	25.4	--
Dryer Discharge Coarse	18.6	1.3	7.0
Dryer Discharge Medium	7.6	1.2	6.5
Dryer Discharge Fine	7.2	16.1	86.5
Cone Underflow	7.6	0.3	--

Data Point 2

Feed	26.0	25.9	--
Dryer Discharge Coarse	10.0	1.7	6.7
Dryer Discharge Medium	3.0	1.3	5.1
Dryer Discharge Fine	3.2	22.4	88.2
Cone Underflow	3.2	1.8	--

Data Point 3

Feed	23.8	26.7	--
Dryer Discharge Coarse	10.4	7.1	30.9
Dryer Discharge Medium	3.2	1.5	6.5
Dryer Discharge Fine	2.2	14.4	62.6
Cone Underflow	2.2	3.5	--

TABLE 3

ROTARY DRYER OPERATING PARAMETERS

Whey Studies

1. Run W-1 Reference Pages 50, & 51
Feed: Whey as received (10.5% moisture)
Burner: On
Exhaust Fan Pulley Diameter: 10" Air Velocity: 65.5 ft/min.
Feed Rate: + 340 lb/hr. Dryer Slope: 7/12"/ft.
Data Point 1 % wt. on Basis
of Total Discharge
Time: 10 minutes
Dryer Discharge: 51.25 lb 85.7
Cyclone Underflow: 8.50 lb 14.3
2. Run W-2 Reference Page 52
Feed: Whey as received (10.5% moisture)
Burner: On
Exhaust Fan Pulley Diameter: 10" Air Velocity: 65.5 ft/min.
Feed Rate: + 8.1 lb/3 min. (162 lb/hr) Dryer Slope: 7/12"/ft.
Data Point 1 % wt. on Basis
of Total Discharge
Time: 5 minutes
Dryer Discharge: 14.25 lb 63.3
Cyclone Underflow: 8.25 lb 36.7
Data Point 2 % Moisture % wt. on Basis
of Total Discharge
Time: 5 minutes
Dryer Discharge: 10.75 lb 1.5 58.9
Cyclone Underflow: 7.50 lb 1.5 41.1
3. Run W-3 Reference Pages 53, & 54
No data was taken. Dried whey was used as feed (from Run W-1) but it did not discharge from the dryer even though the dryer slope was increased.

NOTE: Runs W-4, W-5 and W-6 were conducted while the dryer was tapped along its length for 15 seconds every minute, with a mallet.

4. Run W-4 Reference Pages 55 & 56

Feed: Whey as received (10.5% moisture)

Burner: On

Exhaust Fan Pulley Diameter: 6" Air Velocity: 260 ft/min.

Feed Rate: + 162 lb/hr. Dryer Slope: 7/12"/ft.

Data Point 1: Time: 10 minutes

<u>Product</u>	<u>Dryer Discharge Temperature</u>	<u>Prod. Temp.</u>	<u>Wt. lb.</u>	<u>Percent Moisture</u>	<u>% wt. on Basis of Total Discharge</u>
Dryer Discharge	200°F	92°F	8.75	1.0	47.2
Cyclone Underflow	-	160°F	9.75	-	52.8

Data Point 2: Time: 10 minutes

<u>Product</u>	<u>Dryer Discharge Temperature</u>	<u>Product Temperature</u>	<u>Wt. lb.</u>	<u>% wt. on Basis of Total Discharge</u>
Dryer Discharge	202°F	80°F	9.75	50.6
Cyclone Underflow	-	164°F	9.50	49.4

5. Run W-5 Reference Pages 56 & 57

Feed: Whey as received

Burner: On

Exhaust Fan Pulley Diameter: 6" Air Velocity: 200 ft/min.

Feed Rate: + 162 lb/hr Dryer Slope: 7/12"/ft.

Data Point 1: Time: 10 minutes

<u>Product</u>	<u>Dryer Discharge Temperature</u>	<u>Product Temperature</u>	<u>Wt. lb.</u>	<u>% wt. on Basis of Total Discharge</u>
Dryer Discharge	200°F	110°F	9.75	50.0
Cyclone Underflow	-	146°F	9.75	50.0

Data Point 2: Time: 10 minutes

<u>Product</u>	<u>Dryer Discharge Temperature</u>	<u>Product Temperature</u>	<u>Wt. lb.</u>	<u>% wt. on Basis of Total Discharge</u>
Dryer Discharge	210°F	100°F	8.75	51.5
Cyclone Underflow	-	170°F	8.25	48.5

6. Run W-6

Reference Page 57

Feed: Whey as received

Burner: On

Exhaust Fan Pulley Diameter: 6"

Air Velocity: 120 ft/min.

Feed Rate: + 162 lb/hr

Dryer Slope: 7/12"/ft.

Data Point 1: Time: 10 minutes

<u>Product</u>	<u>Dryer Discharge Temperature</u>	<u>Product Temperature</u>	<u>Wt. lb.</u>	<u>% wt. on Basis of Total Discharge</u>
Dryer Discharge	208°F	120°F	11.25	59.2
Cyclone Underflow	-	158°F	7.75	40.8