JOURNAL OF CURRENT RESEARCH IN FOOD SCIENCE

E-ISSN: 2709-9385
P-ISSN: 2709-9377
JCRFS 2023; 4(2): 01-04

www.foodresearchjournal.com
Received: 02-04-2023
Accepted: 06-05-2023

BS Chauhan
Scientist, Krishi Vighan Kendra, Etawah, C.S. Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Sandeep GM Prasad
Associate Professor, Warner College of Dairy Technology, Shuats, Prayagraj, Uttar Pradesh, India

Correspondence Author:
BS Chauhan
Scientist, Krishi Vighan Kendra, Etawah, C.S. Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Impact on fat content, protein and carbohydrate of skim milk powder of the operating variables

BS Chauhan and Sandeep GM Prasad

Abstract
The paper explain the work was conducted at the mother dairy food and vegetable private limited, Etawah (U.P.). We take inlet air temperature (175 °C) constant, feed flow (Kg/hr), feed concentration (Kg/m^3), feed temperature (°C), outlet air temperature (°C) varies. On the basis of that fat content (%), protein (%) and cabohydrade (%) were calculated.

Keywords: Inlet air temperature, Feed flow, feed concentration, and Feed temperature, Outlet air temperature, Fat content, Protein and carbohydrade

1. Introduction
Spray drying is very effective and economical technique of powder manufacturing. An attractive feature of a spray drying is that the heat damage in the product is small. The development of spread drying technology has therefore been intimately associated with dairy, food, biotechnology and Pharmaceutical industry where heat sensitive materials have to be dried while maintaining the prerequisite microbiological stability in the dried particles. There have been many theoretical and experimental studies published since the 1950s to study spray drying operations. Recent studies show that the computational fluid dynamics (CFS) approach is becoming very useful in optimizing and designing the process and equipment. There is a continuous progress in the experimental and theoretical studies on the spray drying process, developed a computer model and simulation for spray dryer. Assessed the disposition of water spray on a plate in a simple box centrifugation using computational fluid dynamics.

In this work we discuss the utilization of energy in evaporator section and drier section of spray drying. In evaporator section, we consider different variables which is applicable for energy consumption in evaporator. In dryer section we consider different variables which impact in quality of powder and also energy utilization. Simultaneously we optimize the total energy consumption in evaporator and draying section of milk powder plant in Mother Dairy Food and Vegetable Private Limited, Etawah Uttar Pradesh.

Materials and Methods
Evaporation section
The evaporation plant was four-effect falling film type with thermal vapour re-compressor was effected in the first effect and all four effects are working when making dairy whitner, WMP and SMP. The plant consist of three combination of holding tubes. The time of holding of milk in holding tubes are 60 seconds, 60 Seconds, 30 seconds and holding tube inlet temperature is 91 °C. Diameter of the holding tube was 36 mm. Milk was cames out from storage tank at 4 °C then heated to temperature of 44 °C in preheat exchanger, from 44 °C to 66 °C direct contect heat, from 66 °C to 91 °C in direct steam injector.

Milk goto first calandria at 70-72 °C under vaccum, second calandria 67-68 °C, fourth calandria 62-63 °C then third calandria 56-57 °C. Condenser water come out at 52 °C to 53 °C.

At the time of C.I.P.10000 to 15000 litre water is used.

The calandrias consisted of 5 cm diameter tubes welded and expanded to the top and bottom plates. The calandria contains the following sequence:

Calandria No.	No. of Tubes in Part 1	No. of Tubes in Part 2	No. of Tubes in Part 3	Total
1	113	82	NA	195
2	82	89	45	186
3	43	23	15	81
4	24	19	16	59

All the four calandria were connected at bottom to four centrifugal vapour separator with a tangential inlet duct. The vapour separators were built together with spiral tubular preheaters to utilize the heat of vapours coming out of each vapour separator for heating of feed.

A thermo-compressor was installed for compressing the vapours from the second effect vapour separator using low pressure steam and sending the compressed vapours back to the first calandria steam. Steam pressure required at the thermo compressor varied from 7.5 to 9.0 bar depending on the product and the total solid content of the final concentrate required. The vacuum in the plant was created by the condensing the vapour of the fourth effect vapour separator in a surface condenser condenser by spraying cold water. So, the vapour was condensed and drained out. The hot water was going into the cooling tower, cooled and recirculated in the condenser. The non –condensable gases were flused out from the system with the help of vacuum pump.

Spray dryer section

The spray drier was a three stage drier equipped with a shaking bed. Powder after coming out from the drying chamber dry and cool in the vibro fluidizer. The presence of vibro fluidizer helped to permit the operation of the dryer with a higher inlet air temperature and a lower outlet air temperature thus increasing the thermal efficiency. There was also an agglomeration effect in the vibro fluidizer.

The dryer consisted of the following section

Hot air supply section

This section consisted of an air filters, centrifugal air supply fans, steam radiator for hot air generation and air disperser mounted at the top of the drying chamber to uniformly distribute the hot air over the atomized liquid droplets.

Feed section

The feed section consisted of two feed concentrate balance tank to be used alternatively for receiving the concentrated feed from the evaporation side. The feed was pumped by a 50 hp centrifugal pump feed to high pressure pump/ homogenizer through the concentrate tubular heater to spray nozzles. The pre heater was a shell and coil type pre heater.

Product recovery section

The dried powder from the chamber passed to the static bed and shaking bed respectively where drying and cooling took place. The powder from the shaking bed was shifted in a vibratary sieve and collected in 25 kg jute bags inside HDPE bags.

Fine particle from the dryer is sucked by the duct to the cyclone. Where fine particles was collected and from the cyclone fines particles went to the drying chamber for re-wetting and re-drying for making agglomeric powder,

Quality parame ters:

1. Fat content
2. Carbohydrade
3. Protein

Measurement and control of independent variables

1. Inlet air temperature-measured by duplex RTD
2. Outlet air temperature-measured by duplex RTD
3. Feed concentration-Density Meter
4. Feed temperature-Measured by RTD
5. Feed flow-Measured directly by flow meter gauge connected before the inlet of evaporator

Results and Discussions

Table 1: Experimental Data for Fat Content in SMP at 175 °C Inlet Air Temperature

Feed Flow (Kg/hr)	Feed concentration (Kg/m^3)	Feed Temperature (°C)	Fat Content (%) Outlet Air Temperature (°C)		
			81	82	83
2200	1175	63	0.25	0.27	0.28
2200	1175	65	0.24	0.25	0.27
2200	1175	67	0.23	0.24	0.25
2200	1180	63	0.27	0.29	0.31
2200	1180	65	0.26	0.27	0.29
2200	1180	67	0.25	0.27	0.29
2200	1185	63	0.30	0.31	0.33
2200	1185	65	0.29	0.30	0.31
2200	1185	67	0.28	0.29	0.30
2400	1175	63	0.34	0.35	0.36
2400	1175	65	0.32	0.33	0.35
2400	1175	67	0.31	0.33	0.35
2400	1180	63	0.35	0.37	0.39
2400	1180	65	0.34	0.35	0.36
2400	1180	67	0.33	0.34	0.36
2400	1185	63	0.35	0.37	0.39
2400	1185	65	0.31	0.33	0.34
2400	1185	67	0.30	0.32	0.33
2600	1175	63	0.40	0.42	0.43

2600	1175	65	0.38	0.39	0.41
2600	1175	67	0.36	0.38	0.39
2600	1180	63	0.42	0.43	0.45
2600	1180	65	0.41	0.42	0.43
2600	1180	67	0.40	0.41	0.42
2600	1185	63	0.45	0.46	0.47
2600	1185	65	0.43	0.45	0.46
2600	1185	67	0.42	0.43	0.45

Table 2: Experimental Data for Protien of SMP at 175^{0}C Inlet Air Temperature

Feed Flow (Kg/hr)	Feed Concentration (Kg/m^3)	Feed Temperature (°C)	Protein (%) Outlet Air Temperature (°C)		
			81	82	83
2200	1175	63	35.00	35.01	35.02
2200	1175	65	35.02	35.03	35.04
2200	1175	67	35.02	35.04	35.05
2200	1180	63	35.03	35.04	35.05
2200	1180	65	35.04	35.05	35.06
2200	1180	67	35.05	35.05	35.06
2200	1185	63	35.06	35.06	35.07
2200	1185	65	35.07	35.08	35.09
2200	1185	67	35.09	35.10	35.11
2400	1175	63	35.11	35.12	35.13
2400	1175	65	35.13	35.09	35.10
2400	1175	67	35.13	35.14	35.15
2400	1180	63	35.15	35.16	35.17
2400	1180	65	35.16	35.17	35.17
2400	1180	67	35.17	35.18	35.19
2400	1185	63	35.18	35.19	35.20
2400	1185	65	35.20	35.21	35.33
2400	1185	67	35.21	35.22	35.23
2600	1175	63	35.22	35.23	35.24
2600	1175	65	35.22	35.23	35.24
2600	1175	67	35.23	35.24	35.25
2600	1180	63	35.24	35.25	35.26
2600	1180	65	35.26	35.27	35.27
2600	1180	67	35.27	35.28	35.29
2600	1185	63	35.28	35.29	35.30
2600	1185	65	35.31	35.32	35.33
2600	1185	67	35.31	35.32	35.33

Table 3: Experimental Data for Carbohydrate of SMP at 175 °C Inlet Air Temperature

Feed Flow (Kg/hr)	Feed Concentration (Kg/m^3)	Feed Temperature (°C)	Carbohydrate (%) Outlet Air Temperature (°C)		
			81	82	83
2200	1175	63	53.01	53.02	53.04
2200	1175	65	53.02	53.04	53.06
2200	1175	67	53.02	53.04	53.06
2200	1180	63	53.04	53.06	53.07
2200	1180	65	53.06	53.07	53.08
2200	1180	67	53.06	53.07	53.08
2200	1185	63	53.07	53.08	53.09
2200	1185	65	53.07	53.09	53.10
2200	1185	67	53.09	53.10	53.12
2400	1175	63	53.12	53.13	53.14
2400	1175	65	53.13	53.14	53.15
2400	1175	67	53.14	53.16	53.18
2400	1180	63	53.17	53.18	53.19
2400	1180	65	53.18	53.19	53.20
2400	1180	67	53.20	53.22	53.24
2400	1185	63	53.22	53.24	53.26
2400	1185	65	53.26	53.28	53.30
2400	1185	67	53.28	53.30	53.32
2600	1175	63	53.32	53.34	53.36
2600	1175	65	53.36	53.38	53.40
2600	1175	67	53.40	53.42	53.44
2600	1180	63	53.44	53.46	53.48

2600	1180	65	53.48	53.50	53.52
2600	1180	67	53.52	53.54	53.56
2600	1185	63	53.56	53.58	53.60
2600	1185	65	53.62	53.64	53.66
2600	1185	67	53.66	53.68	53.70

Results shows that at 175 °C inlet air temperature, when feed flow, feed concentration, feed temperature and outlet air temperature increases, the fat content of the powder also increases from 0.23 to 0.47%, protein ranges from 35 to 35.33% and carbohydrate ranges from 53.01 to 53.70%. All the three parameters are within the range of industry limit.

References

1. Nikolova Y, Petit J, Gianfrancesco A, Sanders CFW, Scher J. Impact of Spray Drying Process Parameters on Dairy Powder Surface Composition and Properties. An International Journal of Drying Technology. 2015;33:1654-1661.
2. Nino Alfredo Dominquez, Lozano Denis Cantu, Ragazzeo-Sanchez Juan A, Gonzalez ISSAC Andrade and Luna, Solano Guadalupe. Energy Requirements and Production Cost of the Spray Drying Process of Cheese Whey. An International Journal of Drying Technology. 2017;36(5):597-608.
3. Nguyen Due Quang, Nquyen Thu ha, Mounir Sabah AndAllaf Karim. Effect of Feed Concentration and Inlet Air Temperature on the Properties of Soyamilk Powder Obtained by Spray Drying. An International Journal of Drying Technology. 2018;36(7):817-829.