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Who Are the Top 100© Food & Beverage Companies?

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Business Issues for All Food Processors

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The Top Food & Beverage Processors

Our Top 100© ranks the largest food processors in the U.S. and Canada.

By Dave Fusaro, Editor in Chief, Food Processing

Two things strike us as we examine this year's list of the 100 largest food & beverage processors in the U.S. and Canada:

- A couple of companies have become so big and unfocused that they will or already have split into two companies.
- 2011 was very tough year on some of these companies.

This is our 37th annual Top 100©. It ranks food & beverage processors based on their sales of value-added, consumer-ready goods that were processed in U.S. and Canadian facilities. You won't find a comparable list anywhere else; you won't find many of these figures anywhere else, either.

The first thing we remarked on last year at this time was just one company out of that whole bunch reported a loss in 2010. That dubious distinction belonged to Dole, which got squeezed by both lower banana production worldwide and weaker pricing – how does that happen?

(You'll notice one additional 2010 loss in this year's chart. Michael Foods was a private company in 2010 and did not report earnings, but in its pro forma computations, it acknowledged a loss in 2010).

We can't say the same this year. Dole recovered, to a $38 million profit, but six others swung into the red. At the top of that list is Dean Foods, which swung from an $83 million profit in 2010 to a $1.6 billion loss in 2011.

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Ranking	Previous Ranking	Company Name	2011 Food Sales	2010 Food Sales	2011 Total Company Sales	2011 Net Income (-Loss)	2010 Net Income (-Loss)
			All figures are in millions of U.S. dollars				
1	1	**PepsiCo Inc.**	$38,396[1]	$35,600	$66,504	$6,462	$6,338
2	4	**Tyson Foods Inc.** (10/1/11)	30,975	27,293	32,266	733	765
3	2	**Nestle (U.S. & Canada)**	26,200	29,600	94,000	10,500	35,000
4	3	**Kraft Foods Inc.**	25,171	29,524	54,365	3,547	4,139
5	5	**Anheuser-Busch InBev**	15,304	15,296	39,046	7,959	5,762
6	6	**JBS USA**	14,000[E]	13,342	14,000[E]	NA	117
7	8	**Dean Foods Co.**	12,698	11,758	13,055	(-1,592)	83
8	7	**General Mills Inc.** (5/27/12)	12,464	12,005	16,658	1,589	1,804[R]
9	10	**Smithfield Foods Inc.** (4/29/12)	11,093	10,264	13,094	361	521
10	9	**Mars Inc.**	10,500	10,500	30,000	NA-Private	NA-Private
11	13	**Coca-Cola Co.**	9,861	8,273	46,452	8,572	11,809
12	12	**Kellogg Co.**	8,873	8,402	13,198	1,231	1,247
13	14	**ConAgra Foods Inc.** (5/29/12)	8,377	8,002	13,263	474	819
14	16	**Cargill Inc.** (5/31/12)	8,000[E]	7,000[E]	119,500	2,690	1,990[R]
15	15	**Hormel Foods Corp.**	7,895	7,221	7,895	479	396
16	11	**MillerCoors LLC**	7,550	7,571[R]	7,550	1,004	1,057
17	17	**Dole Food Co. Inc.**	7,224	6,893	7,224	38	(-30)
18	18	**Pilgrim's Pride**	6,779	6,237[R]	7,536	(-497)	87
19	21	**Saputo Inc.** (3/31/12)	6,423	5,606	6,930	381	450
20	23	**Hershey Co.**	6,081	5,671	6,081	629	510
21	20	**Unilever North America**[2]	5,986	6,688	60,168	5,986	6,093[R]
22	24	**Dr. Pepper Snapple Group**	5,903	5,636	5,903	606	528
23	25	**Maple Leaf Foods**	4,894	4,968	4,894	82	26
24	28	**Ralcorp Holdings**	4,741	4,049	4,741	(-187)	209
25	27	**H.J. Heinz Co.** (4/27/12)	4,661	4,679	11,649	978	1,006
26	29	**Perdue Farms** (3/31/12)	4,500[E]	3,900[E]	4,500[E]	NA-Private	NA-Private
27	19	**Sara Lee Corp.** (7/2/11)	4,434	6,819	8,681	1,287	527
28	26	**J.M. Smucker Co.** (4/30/12)	4,392	3,884	5,526	460	479
29	32	**Land O'Lakes Inc.**[3]	4,344	3,455	12,849	182	178
30	22	**Campbell Soup Co.** (7/31/11)	4,060	4,278[R]	7,719	802	844
31	30	**Bimbo Bakeries USA**	3,843	3,864	9,550	404	341
32	34	**Agropur Cooperative** (10/30/11)	3,651	3,345	3,651	45	39
33	33	**Brown-Forman Corp.**	3,614	3,404	3,614	513	572
34		**E&J Gallo Winery**	3,400[E]	NA	3,400[E]	NA-Private	NA-Private
35	36	**Procter & Gamble Co.**	3,156	3,135	82,559	241 (food only)	326[E] (food only)
36	35	**Chiquita**	3,139	3,227	3,139	57	57
37	31	**Del Monte Foods** (5/1/12)	3,101	3,666	3,101	362	661
38	38	**Flowers Foods Inc.**	2,773	2,574	2,773	123	137
39	48	**Constellation Brands** (2/29/12)	2,654	2,088	2,654	445	58
40	40	**Hostess Brands**	2,500	2,500	2,500	NA-Private	NA-Private
41	41	**Pinnacle Foods**	2,470	2,437	2,470	(-47)	22
42	45	**Rich Products Corp.**	2,400	2,250	3,025	NA-Private	NA-Private
43	44	**Keystone Foods**	2,300[E]	2300[E]	11,723[4]	(-399)[4]	NA-Private
	39	**McCain Foods** (6/30/11)	2,300	2,555	6,100	NA-Private	NA-Private
45	46	**Foster Farms LLC**	2,200	2,200	2,200	NA-Private	NA-Private
	47	**H.P. Hood Inc.**	2,200	2,200	2,200	NA-Private	NA-Private
47	43	**Parmalat**	2,178	2,132[R]	5,815	201	211
48	42	**Borden Dairy Co.**[5]	2,100[E]	2100[ER]	2,100[E]	NA	NA
49	49	**Molson Coors Co.** (Canada only)	2,067	1,938	3,516	674	668
50	51	**TreeHouse Foods Inc.**	2,050	1817	2,050	94	91
51	59	**Seaboard Corp.**	2,005	1,584	5,747	346	284
52	56	**Associated Milk Producers**	2,000[E]	1,700	2,000[E]	NA	NA
	55	**California Dairies Inc.**	2,000[E]	1,710	3,000	NA	NA
54	50	**Sanderson Farms**	1,978	1,925	1,978	127	135
55	52	**Great Lakes Cheese Co.**	1,900[E]	1,800[E]	1,900[E]	NA-Private	NA-Private
	53	**Schreiber Foods Inc.**	1,900[E]	1,800[E]	4,100[E]	NA-Private	NA-Private
57	62	**Cott Corp.**	1,809	1,357	2,335	41	58
58	54	**Schwan Food Co.**	1,800[E]	1,750[E]	3,600[E]	NA-Private	NA-Private
59	57	**Weston Foods**	1,772	1,624	32,376	919	278 (food only)
60	63	**Michael Foods**	1,767	1602	1,767	14	(-31)
61		**Snyder-Lance Inc.**[6]	1,635	980	1,635	38	3
62	60	**Prairie Farms Dairy Inc.** (9/30/11)	1,600[E]	1,504	1,600[E]	NA	NA
63	58	**Canada Bread Co.**	1,596	1,588	1,596	52	61
64	67	**McCormick & Co. Inc.** (11/30/11)	1,590	1,204	3,698	374	370
65	68	**American Crystal Sugar Co.**	1,543	1,204	1,543	805[7]	526[7]
66	61	**Dannon Co. Inc.**	1,490	1,360	1,490	NA	NA
67	69	**American Foods Group LLC** (9/30/11)	1,428[E]	1,200	2,500	NA-Private	NA-Private
68	70	**J. R. Simplot Co.** (8/31/11)	1,400[E]	1,200[E]	5,600	NA-Private	NA-Private
69	66	**AdvancePierre Foods LLC**	1,300[E]	1,300[E]	1,300[E]	NA-Private	NA-Private
70		**Beam Inc.**[8]	1,271	NA	2,871	911	488
71	72	**Seneca Foods Inc.** (3/31/12)	1,261	1,195	1,261	11	18
72	73	**Leprino Foods Co.**	1,250[E]	1,125[E]	2,500	NA-Private	NA-Private
73	74	**McKee Foods Corp.**	1,100[E]	1,100[E]	1,100[E]	NA-Private	NA-Private
	75	**OSI Group**	1,100[E]	1,100[E]	4,500[E]	NA-Private	NA-Private
	79	**Wells Enteprises Inc.**	1,100	1,000	1,100	NA-Private	NA-Private
76	76	**Colgate-Palmolive Co.**	1,032	1,025	16,734	2,431	2,203
77	81	**Dairy Farmers of America**[3]	1,000[E]	927	13,000	40	44
		Glanbia USA	1,000[E]	900[E]	4,144	265	229
	78	**Hilmar Cheese Co.**	1,000[E]	1,000[E]	1,400[E]	NA	NA
80	64	**Darigold** (3/31/12)	933	900[R]	933	NA	NA
81	83	**Lancaster Colony Corp.** (6/30/11)	923	893	1,090	106	115
82	88	**Hain Celestial Group**	910	724	1,130	55	27
83	87	**Agri-Mark**	900	781	900	15	11
84	85	**Gilster-Mary Lee Corp.**	880	850	880	NA-Private	NA-Private
85	84	**Sunkist Growers** (10/31/11)	864	874	1,019	NA	789[7]
86	77	**Foremost Farms USA**	850[E]	850[ER]	1,700[E]	NA	25
87	82	**Imperial Sugar Co.** (9/30/11)	849	908	849	(-53)	137
88	94	**Diamond Foods Inc.**	816	570[R]	966	50	26
89	New	**Hearthside Food Solutions LLC**	804	NA	804	NA-Private	NA-Private
90	86	**Lactalis American Group Inc.**	800[E]	800[E]	800[E]	NA	NA
91	92	**Malt-O-Meal Co.**	750	690	750	NA-Private	NA-Private
92	91	**J&J Snack Foods** (9/24/11)	744	697	744	55	48
93	95	**CROPP Cooperative/Organic Valley**	715	619	715	NA	NA
94	New	**Agro-Farma Inc. (Chobani)**	700[E]	NA	700[E]	NA-Private	NA-Private
	97	**Golden State Foods**	700[E]	560[E]	5,000	NA-Private	NA-Private
	89	**Sargento Foods Inc.** (6/30/11)	700[E]	700[E]	1,000[E]	NA-Private	NA-Private
	90	**Reser's Fine Foods**	700	700	700	NA-Private	NA-Private
98	96	**John B. Sanfilippo & Son Inc.** (6/30/11)	674	562	674	3	14
99	98	**Gorton's**	666	560	6,859	NA	NA
100	93	**National Grape Cooperative**	641	659	641	25	27

Notes

1. This fiscal year was 53 weeks.
2. For companies reporting in euros, year-to-year comparisons may not be fair because the euro was significantly lower at the end of 2011 than it was in 2010.
3. Does not include raw milk transported
4. Total sales and income figures are for parent Marfrig Alimentos SA, Brazil
5. Formerly referred to as Lala USA, and earlier National Dairy Holdings
6. Previous year's figures were for predecessor company Lance Inc.
7. Payments made to co-op members
8. Formerly part of Fortune Brands, spun off on October 3, 2011.

A. Subjective adjustments were made to company financial statements.
E. Estimate
R. Figure is restated from what we carried last year
NA. Not Available

MERGERS & ACQUISITIONS	2011 closed[1]	2010 closed[1]	2009	2006	2003
Agricultural Cooperatives	1	0	1	5	NA
Diversified Firms	17	10	5	0	9
All Food Processors	63	58	58	110	120
Bakers	3	3	5	6	3
Brewers, Distillers, Wineries	6	4	8	4	
Confectioners	4	1	2	3	15
Dairy	3	5	7	5	13
Fruit & Vegetable	3	12	4	7	25
Meat	7	3	3	13	11
Multi-Product	26	21	16	43	14
Poultry	2	1	3	0	3
Seafood	2	1	3	8	0
Snack Food	4	5	3	2	16
Others	3	2	4	15	16
Soft Drink/Water/Juice	5	12	20	19	
Total[2]	285	238	264	392	368

1. In addition to deals closed in a given year, there are some that carry into the following year. There are 50 2010 acquisitions that did not close in 2010.
2. There are seven other categories (e.g., restaurants, retailers) that are not included in this table, but are in the final numbers.
Source: The Food Institute

Sales were up 7.7 percent, but the cost of raw milk jumped 24 percent. Homogenize in "industry-wide volume softness across dairy product categories," as Dean Foods' annual report explains, and the result is painfully low margins. In 2009 just the opposite happened: Sales were down but net income went way up.

But the price of raw milk abated at the end of 2011. "In 2012, we expect difficult conditions to continue for the broader fluid milk industry, but we are cautiously optimistic," Chairman/CEO Gregg Engles wrote in the annual report.

Maybe Dean should consider splitting up?

Also reporting losses in 2011 were Pilgrim's Pride (-$497 million), Ralcorp Holdings (-$197 million), Pinnacle Foods (-$47 million), Keystone Foods (its parent firm, Brazil's Marfrig Group, lost $399 million) and Imperial Sugar (-$53 million).

Pilgrim's Pride has had a troubled recent history. It emerged from bankruptcy protection in 2010 with Brazilian beef processor JBS acquiring a 64 percent stake (now 67 percent). In 2011, the culprit was high feed prices. "Market prices for feed ingredients … rose significantly again from the third quarter of 2010 to the second quarter of 2011. These prices remained at historically high levels throughout the third quarter of 2011 before decreasing in the fourth quarter of 2011," the company wrote in its 10-K SEC report.

FOOD MERGERS UP, BUT SLOWING

The Food Institute recorded a total of 381 mergers in the larger food & beverage industry in 2011, an increase of about 20 percent over the 317 deals in 2010. While the numbers are comparatively high when considering the lull in 2009 that followed the recession, when mergers dipping to 264, they're well below recent highs of 422 in 2008 and 473 in 2007, when credit was good and money was cheap.

Among just food & beverage processors, the results are similar: 63 mergers were completed, another 17 are still pending – higher than the 58 in both 2009 and 2010 but below the 110 recorded in three consecutive years: 2006-2008.

(The Food Institute includes in its definition of the food industry a number of other entities, such as brokers, consultants & other service providers, investments firms & banks, packaging & equipment suppliers, raw product & ingredient suppliers, restaurants & foodservice, retailers, and wholesalers & distributors.)

In addition to interest in growing segments, the activity also marks the re-entry of private capital and investors into the food industry, the institute notes.

Among prominent deals: On Oct. 3 of 2011, Sara Lee Corp. completed the sale of its North American refrigerated dough business to Ralcorp Holdings for $545 million. That presaged Sara Lee's split (concluded this June) into an American processed meats company (Hillshire Brands) and a European coffee company (D.E Master Blenders 1753 NV). As a result of that strategy, Sara Lee also sold a majority of its North American foodservice coffee and tea operations to J.M. Smucker Co. for $350 million, but acquired Aidells Sausage Co. for $87 million.

Ralcorp was the target of an acquisition itself, but refused to talk with ConAgra Foods about its $5.18 billion takeover bid, which began in March of 2011. Analysts claim Ralcorp's board risked costing shareholders a billion dollars by walking away from ConAgra's offer in favor of splitting up the company.

The Food Institute claims current Ralcorp and the Post Foods unit it spun off were worth a combined $86 per share at the time of the separation, while ConAgra was offering $94 (and the Food Institute says it could have been $104 a share) to secure a deal (according to BMO Capital Markets and reported by Bloomberg Businessweek Sept. 15, 2011).

Our readers can buy the full "Food Industry Mergers & Acquisitions" report at www.foodinstitute.com/manda.cfm or by contacting Sue Antista at 201-791-5570, ext. 212.

And even before this summer's drought, Pilgrim's Pride executives warned, "Market prices for feed ingredients remain volatile. Consequently, there can be no assurance that the price of corn or soybean meal will not continue to rise as a result of, among other things, increasing demand for these products around the world and alternative uses of these products, such as ethanol and biodiesel production."

Breaking up is easy to do

Ralcorp and possibly Dole are examples of another trend we see in this report. 2011 and 2012 may be remembered as the years of the big splits. Fortune Brands, historically a diversified holding company, started the trend late last year when, after selling off its Titleist and FootJoy golf product lines, it split into two publicly traded companies: Fortune Brands Home & Security (with Moen faucets, Aristokraft and Kitchen Craft cabinetry and Master Lock security products, among others) and Beam Inc. (with such intoxicating brands as Jim Beam and Maker's Mark bourbons, Sauza tequila and Canadian Club whiskey).

Ralcorp was forced into it. With ConAgra waging a semi-public campaign through most of 2011 to buy the company, because of ConAgra's burgeoning interest in private label, Ralcorp responded by rewarding shareholders and diluting its own worth. This past February, it spun off to stockholders its Post Cereals business, which it had bought from Kraft in 2008. That makes Ralcorp again an overwhelmingly private label company. (Since the Post spinoff was a 2012 event, Post's sales remain in Ralcorp's figures in this year's table.)

Then came Sara Lee. It too had become a curiously diversified holding company, balancing its namesake and Jimmy Dean brands against Kiwi shoe polish and Hanes underwear. It started its refocusing in 2005, selling off one extraneous product line after another. Billion-dollar divestitures included its global body care and European detergents business to Unilever in 2009 and its North American bakery unit to Grupo Bimbo in late 2010.

But last year company officials announced they were splitting the remainder of the company into two publicly traded companies. North American food operations – primarily Jimmy Dean, Ball Park and Hillshire Farm brands – on June 28 became Hillshire Brands, soon to be headquartered in Chicago. Several European coffee brands (including Douwe Egberts) became D.E Master Blenders 1753, based in Amsterdam.

Next up: Kraft. The company just set Oct. 1 for its split into a $16 billion North American grocery business and a $32 billion global snacks business. The name of the former will be Kraft Foods Group Inc.; Mondelez International Inc. will be the latter.

And now Dole is hinting that it might sell off its canning and processed food operations and maybe its small vegetables business to become a purely fresh fruit company. As a result of its slumping stock price this year, Dole now has more debt than its current market valuation, reports Bloomberg News. Ironically, the company's packaged foods unit has been growing fastest, while the fresh fruit business has been hampered by low prices.

Only one of those splits shows up on this year's Top 100© table. While all the figures are the most recently available, that still means full-year results from calendar 2011 for most of these companies. Beam Inc. is the exception. Despite a late-2011 split from Fortune Brands, the spirits company published its own 2011 annual report.

Another newbie, debuting at No. 94, is Agro-Farma Inc., better known as Chobani. Everyone knows the meteoric growth of Greek yogurt. Agro-Farma made it onto our chart for the first time, but our $700 million figure for the company is just an estimate, based on public documents; Agro-Farma officials declined our requests for information.

On the other hand, Hearthside Foods (No. 89) asked us to right a wrong. As a private labeler and contract manufacturer, the Downers Grove, Ill.-based company likes keeping a low profile, but officials volunteered their qualifications for the Top 100©. FP

METHODOLOGY

This is our 37th annual Top 100© ranking. It's meant to rank food & beverage processors based on their sales of value-added, consumer-ready goods that were processed in U.S. and Canadian facilities. As a result, you won't find many of these figures anywhere else.

We apply the same general rules to every company, but unique interpretations seem to apply to almost every processor. Certainly all grocery store-ready, packaged and branded food and beverage products are included. Even beef patties sold to McDonald's … but not raw meat or even ground beef sold to another food processor. Not ingredients. Nor raw milk. Exports are OK, but not products manufactured overseas, regardless of where they're sold.

So while PepsiCo Inc.'s annual report shows $66.5 billion in global sales in 2011, we count only the sales of Frito-Lay North America, Quaker Foods North America and Pepsi Americas Beverages to get $38.4 billion.

We use the most recent fiscal year for which figures are available. For most, that means calendar 2011, but you'll see some FY2012s in there. For all the foreign-based companies, we convert foreign currencies to U.S. dollars as of Dec. 31, 2011, or on the last day of their fiscal year, unless otherwise directed by the company. As a result currency fluctuations can distort some companies' real performance in their home currencies.

And while we look at the SEC filings (10-K's) for all the public companies, there are a lot of private companies in this business. From some, we get voluntary cooperation. For others, we scour media reports and other documents to come up with our estimates.

Did we leave out your company, as in the past we did Hearthside Foods? Email me (dfusaro@putman.net) your figures and we'll get you in the online list immediately and into next year's print edition.

Heating Methods for Ultra-High Temperature Pasteurization

By Michael Campbell, Pick Heaters

The move is on for ultra-high temperature (UHT) pasteurization, which will extend the shelf life of milk and other dairy products. UHT pasteurization is being used because consumers are buying more dairy products in bulk, dairy operations are becoming larger, and population expansion is increasingly causing consumers to be located in more remote locations throughout the world.

Traditionally, milk is pasteurized at 180-185°F (about 85°C) and refrigerated. Other dairy products are commercially sterilized by subjecting product to temperatures in excess of 100°C, and then packaging it in airtight containers. The basis of UHT is sterilization of the product before packaging, then packaging it in pre-sterilized containers in a sterile atmosphere. Processing dairy products in this manner, using temperatures exceeding 135°C, permits a reduction in the required hold time to 2-5 seconds, and yields a shelf stable product that can be stored for extended periods of time at ambient temperature.

Some examples of food products processed under UHT conditions are:

- Liquids such as milk, juices, yogurts, cream, and salad dressings.
- Foods with small particulates – baby food, soups, sauces, and stews.
- Soy based products in order to inactivate bacteria and reduce off flavors.

The traditional problems or difficulties in using a UHT process have been:

- Sterility: The complexity of the equipment requires more highly skilled operators to maintain sterility through out the aseptic process.
- Particulate Size: With larger particulates comes the danger of overcooking of the product surface.
- Product Quality: Heat stable lipases or proteases can lead to flavor deterioration. In a number of cases flavor deterioration has caused a more pronounced cooked flavor for UHT milk as an example.

A major consumer complaint about UHT products has always been the so-called unpleasant "cooked" taste and sometimes-brown color of the finished product. This is understandable when we remember that dairy products in general, and specifically milk, are a colloidal mixture of water, lipids, carbohydrates, and proteins. When the mixture is heated under pressure to ultra-high temperatures, the protein structure is altered in such a way that some of the proteins are denatured and off flavors or browning can occur.

The conventional method for heating products to ultra-high temperatures has been to use indirect heating such as 1) plate and frame heat exchangers, 2) tubular-type heat exchangers such as shell and tube, or 3) scraped surface heat exchangers. The other current method for UHT production is steam infusion.

The goal of the equipment manufacturer today is not only to design equipment that can process product at increased product flow rates (over 35,000 liters per hour), operate continuously for more than 20-hours a day, and be easily inspected and cleaned, but also to design equipment that can minimize off flavors and browning.

Current UHT Cooking Methods

Indirect Heating

With this method the heating medium and product are not in direct contact with each other. As mentioned earlier, the types of heat exchangers are plate and frame, tubular, and scraped surface. The advantage of using these types of exchangers is that you do not need culinary steam since the two media are kept separate. However, each type of exchanger has its own disadvantages.

- Plate and Frame Exchangers: While they are typically easy to inspect and take up less floor space than other types of indirect exchangers, they are limited by gasket temperatures and pressures. In most cases the EPDM gasket is limited to a maximum 160°C. The plates, while easy to take apart, can over time become fatigued as they flex from the constant high temperature steam and lower temperature product passing over the contact surface. Liquid velocities are usually lower for a plate and frame exchanger arrangement and as such can lead to uneven heating and potential burn-on and browning.
- Tubular Exchangers: While they have fewer seals and therefore do not suffer as much from gasket limitations or plate fatigue, they typically take up more floor space and are not easy to inspect. Heating may be more uniform, however browning or burn-on is possible because of the large surface area required to achieve the desired set point.
- Scraped Surface Exchangers: This type of exchanger forces product through a jacketed tube in which a set of rotating blades is constantly moving product from the outer walls toward the center. The product is more evenly heated and there is less opportunity for product browning or burn-on. Scraped surface exchangers are also more suitable for highly viscous products and products containing particulates. A general negative has always been the time and cost required for inspection and maintenance of this equipment.

A final point concerning indirect heat exchangers is that while they do a good job of heating product at a fixed liquid flow rate, they suffer when the liquid side flow rate varies. The potential for burning increases as the liquid flow rate decreases.

Steam Infusion

The general concept is to take the liquid product stream and have it pumped at a higher pressure through a distribution nozzle into a chamber filled with slightly lower pressure, culinary quality steam. This system is characterized by cascading a small volume of product through a large steam chamber. The product then collects at the bottom of the chamber and is fed forward via a timing pump.

Product temperature is generally controlled by pressure. Additional holding time is accomplished through the use of hold tubes, plate and frame exchangers or tubular exchangers. This is followed by flash cooling in a vacuum chamber where all added moisture is removed as needed.

Variations of this method involve 1) pre-heating the product to a desired set point before the addition of direct contact steam, or 2) using the steam infusion method first followed by flash steam removal and perhaps reheating to a uniform set point.

All of these steam infusion methods accomplish the same thing:

- Instantaneous heating and rapid cooling.
- Lack of overheating or burn-on.
- Heating of low and high viscosity products.
- Use of variable product flow rates.

The negatives of steam infusion are:

- Size: The infusion chambers take up a sizeable amount of useable production floor space.
- Sanitation: These systems are not easily cleaned.
- Capital Outlay: Units require high, initial capital investment.
- Operations: A fairly skilled work force is required to monitor pressures, feed pump flow rates, etc.
- Need for a Timing Pump: Added equipment and operating cost.

Direct Steam Injection

More than a Viable Alternative

Like steam infusion, Direct Steam Injection uses culinary steam to quickly heat a food product to the desired UHT temperature. Direct Steam Injection blends the liquid stream with the higher pressure steam using multiple orifice injectors, static mixers or venturi type injectors. The key is to get the product to quickly absorb all the steam energy and elevate its temperature as quickly as possible. Unlike steam infusion it does not require a large chamber filled with steam with a higher pressure liquid cascading through it to achieve the quick heat transfer of steam and liquid.

The immediate advantage of this type of mixing is that the mixing chamber isn't much bigger than the liquid transfer piping. The overall assembly has a minimal footprint and the mixing chamber itself is especially small and easy to clean or inspect. Often the chamber requires no more than opening three quick release clamps to remove the device from the process line.

Because the steam has intimate contact with the product, the Direct Steam Injection method maximizes heat transfer. Another important feature is that the same system can, for the most part, process a wide variety of slurries to a desired set point. Some systems, depending on their designs, can even process particulates with little or no product degradation.

Pick Sanitary Heater with a threaded steam line consisting of an iron steam strainer, steam control valve and sanitary non-return check valve.

Another advantage is that Direct Steam Injection systems are available in a range of sizes capable of handling product capacities from 240-liters/hour to more than 20,000-liters/hour. Direct Steam Injection systems also require low capital investment, potentially half as much as any other method being considered.

The main disadvantages to using Direct Steam Injection or even steam infusion are:

- Steam injection – Like steam infusion, requires the use of culinary steam.
- Dilution – Added moisture must be removed using an atmospheric or vacuum flash chamber. Depending on product specifications, this can be minimized or eliminated by preheating upstream of the steam injector.
- Sanitation – Current 3A standards call for COP on steam injector systems so a backup unit or removable spool piece should be considered.

Test Results

One manufacturer of Direct Steam Injection systems and an early pioneer in Sanitary Direct Steam Injection Heating, Pick Heaters regularly tests a variety of food products to confirm cook temperature can be achieved and maintained while maintaining product integrity.

Recently a series of tests were conducted on whole milk with 4.5 percent butterfat to determine whether UHT temperatures could be achieved without browning and off flavors. Using 140-psig steam and liquid pressures of 100-psig, their Direct Steam Injection system was easily capable of a 40°C temperature rise when the product was preheated to 95°C.

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Breaking Up Is Not So Hard To Do

The current frenzy of split-up activity is just the circle of life in the food & beverage industry.

By Dave Fusaro, Editor in Chief, Food Processing

Neil Sedaka may have thought "Breaking up is hard to do" (1962) but food & beverage companies apparently don't agree.

That's probably the headline right now for the financial side of the business, and one of the key points in our 37th annual Top 100© report, which we present on pages 3-7 of this special reprint.

I can't recall a period where so many companies felt the need to break into two or more pieces. Maybe we should have seen this coming. "Bigger is better" may seem like an aphorism, but when you try to manage alcoholic spirits and kitchen faucets, you've got to wonder where are the synergies. Even U.S. processed meats and European coffee brands is a stretch. Surprisingly, apparently so is American grocery brands and international snack foods.

In chronological order, I'm referring above to Fortune Brands (already Beam Inc. in the food & beverage world), Sara Lee (half of which has been renamed Hillshire Brands) and Kraft Foods Inc., which split into Kraft Foods Group and Mondelez International last October. This time last year, when Kraft first mentioned plans for a split, I remarked in print how it sounded like Kraft General Foods going back to one corporate entity and Nabisco going to the other. Deja vu.

The names, details and motivations of the current frenzy are different, of course, but the whole philosophy does take me back to historic moments in the food industry. This circle of life, death and rebirth is nothing new. I looked back at our 1982 Top 100, and the first name on the list was General Foods Corp. Followed by Dart & Kraft Inc. Followed by Beatrice Foods. Skip No. 4 (Coca-Cola is still around) and you have Nabisco Brands, IBP Inc. (PepsiCo at No. 7), Ralston Purina, CPC International and United Brands. A little further down: Consolidated Foods (No. 14), Philip Morris (15), Borden (16) and Carnation Co. (18).

And that's only 20 years ago.

Borden was an interesting case study in its day. In the go-go 1980s, diversification was supposed to shield a company from a downturn in one product category. But how does a company with a dairy background manage businesses in wallpaper, Krazy Glue and chemicals? Interestingly, the Borden name returned to our Top 100 last year when Mexican dairy Lala renamed its American opeations after their leading (acquired) brand name. The circle of life, little Simba, continues.

A few years back, Sara Lee looked similarly disheveled. Kiwi shoe polish and Hanes underwear? Household cleaners and body care. European laundry detergents. See the synergies? There weren't any. By the way, that Consolidated Foods Corp. I mentioned a few paragraphs back was a former name for Sara Lee. We bid good luck to Hillshire Brands, the company's new and focused name. Please stick with the food.

The circle of life also continues with pure, homegrown innovation. Agro-Farma Inc., better known by its Greek yogurt brand name Chobani, cracks our list for the first time. Last year, the newbies were AdvancePierre Foods and Diamond Foods. Not too long ago, the newcomers were B&G Foods, Hain Celestial and Pinnacle Foods. This year, Post Foods will appear on our list (coming in August), thanks to the Ralcorp split.

This is a good time for me to direct you to the online-only components of our Top 100. We have a truly remarkable tool at www.FoodProcessing.com/top100/index.html. You start out looking at the same table you see on pages 4-5, but all the vertical columns are sortable. Click Company Name to make the list alphabetic. Sort it by Total Company Sales. Or create a list based on profitability. However you sort it, click on a company name and you get each company's profile – headquarters addresses, top executives, subsidiaries, even brands. You may want to refer to it all year.

Who should be our Processor of the Year?

We're already thinking about our final cover story of this year. And asking for your help. The December issue features our Processor of the Year. Official criteria are: "sound financial performance (including expanding sales and profitability), innovative product development, leading manufacturing technology, managerial excellence, general industry leadership and service." If you know a company that fits that description, drop me an email with a company name and a sentence or two on why. Past winners are Heinz, TreeHouse Foods, Nestle USA, Hormel, Mars Snackfood USA, Kellogg and Tyson. Thanks. FP

Rotary Impingement Tank Cleaning Equals Significant Water and Cost Savings

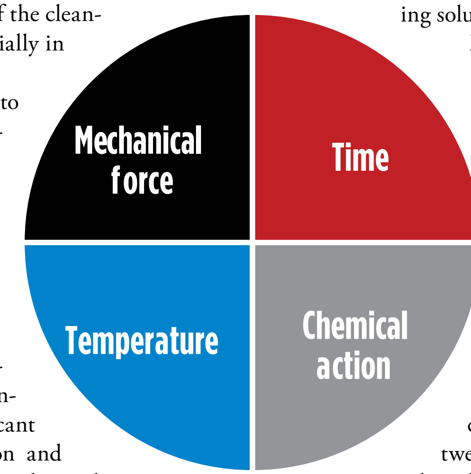
By Gamajet

Tank cleaning has always been viewed as a necessary evil for manufacturers. During the cleaning process, a significant amount of resources (time, chemicals, water, electricity and labor) is required between batches not only to appease FDA standards but to ensure a reliable, uncontaminated, quality batch is produced. Although these repeating expenditures have a significant effect on the bottom line, there are food and beverage manufacturers that continue to rely on outdated yet standardized technology for cleaning, not realizing the potential opportunity for substantial cost reductions and revenue recovery through CIP optimization.

To understand how to optimize a cleaning process, one must first understand the basics of cleaning. Herbert Sinner, a former chemical engineer for Henkel, first summarized the basic principles of cleaning in 1959. His summary, now referred to as the Sinner's Circle, describes the four factors that can be manipulated in any cleaning scenario: Temperature, Chemical Action, Time and Mechanical Force.

When the effectiveness of any factor is reduced, it must be compensated with the increase of one or multiple other factors. Washing dishes is an effective example of how the four factors interact. Hot water (temperature) is going to remove stuck on food better than cold. Adding soap (chemical action) makes the process even easier, and you can either soak a dish overnight (time) or scrub the dish clean (mechanical force). When cleaning tanks, it is imperative to examine not only the effectiveness of the cleaning process but the efficiency as well, especially in such a competitive market.

Sinner's Circle can be easily applied to tank cleaning as a way to compare the efficiency of processes. The most common tank cleaning processes are: wetting (static spray balls), rotary wetting (rotary spray balls), boiling out, manual cleaning and rotary impingement cleaning. Rotary wetting and wetting are more easily understood as a "cascading method." By applying massive amounts of cleaning solution to the tank interior, the residue eventually erodes off. This results in a significant amount of time and effluent consumption and a minimal reliance on temperature and mechanical force (the average force from a spray ball, rotary or static, is approximately .01 lbs). The effectiveness of this cleaning process is accurately described as "fair," often resulting in additional manual cleaning (scrubbing and scraping). The boiling out method offers a similar cleaning at an even slower rate, with even more effluent and temperature, and no mechanical action. Manual cleaning, on the other hand, offers a reasonable amount of mechanical force, with minimal effluent but often results in ineffective cleaning, due to human error. Also, with safety in mind, lower temperatures must be utilized therefore increasing time. Rotary impingement cleaning utilizes the most mechanical force than any other process, therefore reducing time and cleaning solution drastically. Additionally, a repeatable and reliable result is assured.



Sinner's Circle

How rotary impingement works

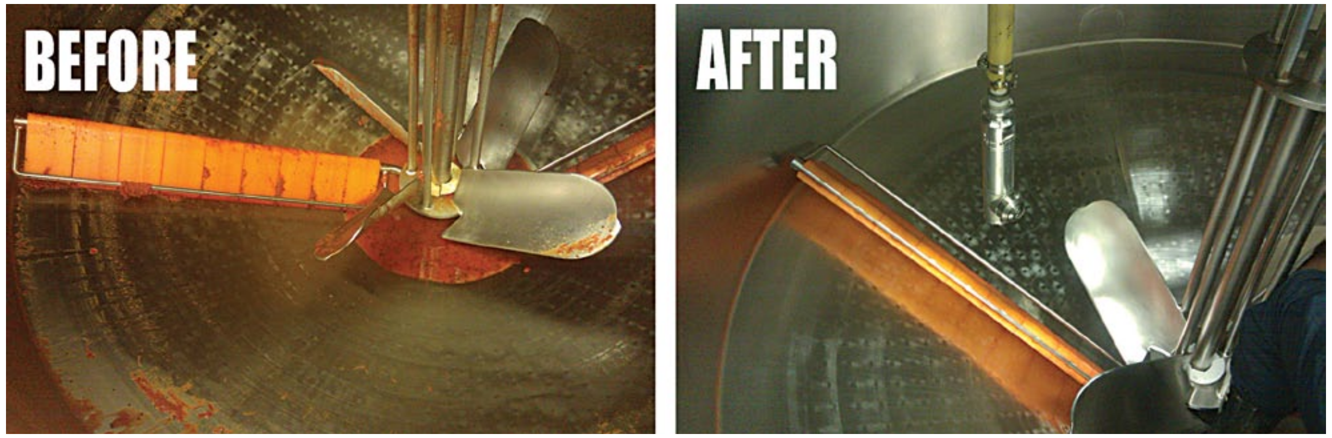
Rotary impingement tank cleaning machines combine pressure and flow to create high impact cleaning jets. Cleaning occurs at the point at which the concentrated stream impacts the surface. It is this impact and the tangential force that radiates from that point which blasts contaminants from the surface, scouring the tank interior. In conjunction with this impact, these machines are engineered to rotate in a precise, repeatable and reliable, 360-degree pattern. This full-coverage, indexing pattern ensures the entire tank interior is cleaned, every time. This combination of impact in a controlled indexing manner results in an economic homerun, because impact is a one-time investment; chemicals, temperature and time are continual, never-ending expenditures.

Following are three specific incidences in which rotary impingement tank cleaning was used to optimize an outdated cleaning solution.

Example 1: Rotary Impingement vs. Fill and Drain

One of the largest hot dog manufacturers was seeking a solution to the abundance of waste water the facility produced. A majority of the focus was spent trying to alter the manufacturing process, which resulted in minimal savings. Eventually they upgraded their entire CIP process, and the final water savings were staggering.

The company utilized a fill and drain cleaning process to clean a series of four ribbon blenders which were used to mix processed meat. Cleaning was required daily, between each batch. The effectiveness of the clean, when dealing with such meats remained the primary concern. The residue, a buildup of oil and fats, and the series of blind spots due to the tank design, caused even more difficulties for the company to clean. Like most food and beverage companies, their cleaning process proved effective enough, thus the cleaning method remained the same for many years. The process included filling the tanks with water and agitating the blenders. This



In one of the worlds largest ketchup manufacturing companies, the Gamajet was used in to clean ketchup from a blender.

was then followed by manually cleaning the blades and under part of the agitator as well as any visually missed spots. Total cleaning time resulted in 4 hours per tank, 5,840 hours of downtime per year. The water consumption was approximately 18,000 gallons per tanks, 26,280,000 gallons per year (a cost of nearly $150,000).

After thorough evaluation, it was suggested the company upgrade their entire CIP process, starting with rotary impingement tank cleaning machines.

The new process included a Gamajet steam-operated pump powering five directional Gamajet V rotary impingement tank cleaning devices. The steam pump allowed for the necessary increase in pressure, as well as the hot water needed to clean oils. Steam was also preferred because the plant already had a steady source of steam and the steam pump is highly energy efficient. The pump allowed for the five Gamajet rotary impingement machines to operate at 15 gpm and 120 psi with 180-degree water. The cleaning process included a 5 minute pre-rinse to rid the tank of any bulk residue, a 10 minute wash and then a 5 minute final rinse. This process took 20 minutes for each tank, which was nearly 90% faster than the previous method, saving them 5,354 hours per year. The water usage was reduced by 92%, 1,500 gallons per tank verses the 18,000 gallons per tank previously. This resulted in the savings of 24 million gallons of water per year, and over $100,000 per year, on water alone. In addition, dangerous manual cleaning was eliminated.

Example 2: Rotary Impingement vs. Manual Cleaning

Manual cleaning is a surprisingly common method. Facilities all over the world are grabbing their hoses, pressure washers and scrub brushes, while locking and tagging out, for their CIP process. Although nearly every other process is automated, many companies still rely on manual cleaning as an effective way, not only to clean, but to validate the cleaning process as well. Human error aside, no manual clean can ever be absolutely replicated. In addition, margins for error are non-existent.

A facility in San Francisco, CA was utilizing manual cleaning to its fullest extent. The company manufactures a wide range of sauces and was experiencing significant revenue loss to their tank cleaning procedure and they were under significant pressure to provide a more validatable clean and eliminate confined space entry. Their process included 4 kettles with dual agitators and the sauces were burnt onto the tanks. The cleaning process included 2 hours of manual cleaning every day. The manual cleaning included confined space entry, scraping and scrubbing which had a significant effect on their tank downtime and water usage. The tank cleaning downtime was 2,920 hours per year and the water usage was 3,504,000 gallons per year which was costing them a total of $16, 293.00 per year.

The solution included two Gamajet PowerFLEX rotary impingement tank cleaning devices, positioned precisely around the agitator to ensure thorough cleaning. The machines operate at 90 psi and 40 gpm per machine with 150-degree water, no chemicals. Cleaning includes a 5 minute pre rinse for the bulk residue, a 10 minute re-circulated wash and a final 5 minute rinse. Total cleaning time per tank is now 20 minutes. The pre-rise of 5 minutes is the length of one-half cycle, and testing proved this to be sufficient for cleaning, however in cases where the residue has burnt on longer an entire cycle is requested for cleaning, followed by the final rinse. This ensures that every area of the tank is passed twice, and satisfies the plant sanitarian. As a result, the facility saves 2,434 hours total in tank downtime per year by cleaning 83% faster. They have also been able to lower the usage of water to 2,336,000 gallons per year, saving them $10,861.80 per year. Production was increased by nearly 10% and confined space entry was completely eliminated.

A quick history into spray balls and other "cascading" devices: Spray balls and rotary spray devices are, to this day, the most common used tank cleaning devices. Static spray balls were introduced in the 1950's with the development of CIP. They work in a way that the wash fluid is discharged from numerous holes.

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Three Paths to a Better Bottom Line

Acquisitions, emerging markets, energy efficiency may help you compete.

By Chris Nay, GE Capital, Corporate Finance; Special to Food Processing

These are challenging days for companies in the North American food processing industry. Overall growth is slow, with most categories tied to incremental population growth in the low single digits. At the same time, profits are being squeezed by escalating commodity costs, which food processors can't easily pass along to price-sensitive consumers. What's more, some retailers are holding the line on price increases and forcing processors to absorb extra costs.

Of course, low growth and difficulty in passing along costs are not new developments, but they are becoming the new normal for the industry. To outperform, companies will need to find creative ways to step up growth, gain pricing power and reduce their own costs to improve margins. These are ambitious goals, but they are achievable. In fact, some companies are already pursuing several pathways to improve their bottom lines, including making strategic acquisitions, entering emerging markets and improving energy consumption.

Strategic acquisitions are particularly compelling today given the ample liquidity in the market. Bankers like the stability of the food & beverage industry and are willing to offer relatively aggressive financing – e.g., higher multiples of EBITDA (earnings before interest, taxes, depreciation and amortization) – to facilitate deals.

In fact, M&A among food processing companies ticked up in 2011. Among food and beverage processors, 63 mergers were completed in 2011, according to the Food Institute. That's higher than the 58 in both 2009 and 2010, but below the 110 recorded in the three consecutive years from 2006-2008.

Strategic acquisitions are a way to grab market share and boost growth. But they are also an avenue to high-growth niches with more pricing power. The recent acquisition of Bolthouse Farms for $1.55 billion by Campbell Soup is a case in point. With the purchase, Campbell is making a foray into the packaged fresh-food category. The $12 billion category is growing at nearly 7 percent – much faster than traditional grocery staples. The deal is also evidence of the ample liquidity in the market. Campbell is paying 9.5 times Bolthouse's EBITDA.

A second growth strategy for food processing companies is to look overseas to grow organically or through acquisitions – specifically to the faster-growing emerging markets where a nascent middle class is driving dramatic changes in food preferences. For instance, spice maker McCormick & Co. made several emerging market acquisitions in 2011 that helped boost sales by 11 percent to $3.7 billion: Kamis SA, a Polish company that makes spices, seasonings and mustards, and Kohinoor Foods Ltd., an Indian company that sells basmati rice and other foods.

McCormick and other companies are enticed by a growing middle class that is adding more protein (meat) and vegetable oils to its diet. It's also consuming more processed foods, as women move into the workforce and have less time to prepare meals at home. These long-term demographic trends bode very well for food processing companies. Consider this statistic from McKinsey: By 2025 China's upper middle class will comprise 520 million people with a combined disposable income of $2.1 trillion.

Acquisitions and forays into emerging markets are not the only levers to improve the bottom line. A third pathway is reducing costs and vigilantly driving efficiencies wherever possible. One cost center that many food processing companies are paying particular attention to is energy consumption.

In most manufacturing processes, food processors need both electrical and thermal energy that they purchase through public utilities. To better manage these costs, some companies are taking a closer look at Combined Heat and Power (CHP), which allows the processor to improve thermal efficiency.

CHP is not a new technology, but its adoption has been held back by the capital expense of building these facilities on site and the slow payback. But some companies – such as Unilever – are avoiding this major capital outlay by partnering with an energy services company (ESCO) or independent power producer (IPP). These companies build the power facility on site for the food processor, which then buys the cheaper energy and reduces greenhouse gas emissions without spending its own capital. This frees up capital to drive the business side.

Making strategic acquisitions, entering emerging markets and improving energy efficiency are just three pathways to a better bottom line. What's critical – given the exceptional challenges in today's global business environment – is that executives think creatively about both the cost and revenue sides of their operations. Only then can they hope to outmaneuver competitors, create a sustainable advantage and improve the bottom line. FP

Chris Nay is senior managing director for GE Capital, Corporate Finance (gecapital.com/food), specializing in providing mid-size food manufacturers and distributors with financing for working capital, growth and turnarounds.

Methods For Mitigation Of Corrosion Under Insulation (CUI) And Other Crevice Corrosion

By Patrick Dunn, Polyguard Products Inc.

Corrosion of steel operating equipment and piping under insulation has been recognized as an important problem in the ammonia refrigeration, chilled water, chemical and petroleum industries. Insulation is a necessary component and there to function in three ways: save energy, control process temperatures, and protect workers from high wall temperatures. The environment under insulation, the CUI environment, can be hot, wet, and promotes aggressive corrosion.

The American Petroleum Institute has directives that address the CUI problem and detail a program of identification, maintenance, and remediation. These directives, as well as efforts by professional societies (NACE and ASTM), promote the development of new solutions. The issue in achieving a good end result is that no clear solution exists for new installed piping as well as maintenance and remediation of existing installations.

NACE Standard RP0198-98 [1] is an excellent source of information for preventing corrosion under insulation, but many corrosion engineers would agree that electrolytes will eventually find their way into even the best system. Selecting the right coating is extremely important. The coating is the last line of defense for keeping the electrolyte from the metal surface and preventing corrosion.

Recent coating innovations include a hydrophobic anti-corrosion gel that is tolerant of less than optimal surface preparation, is designed to keep the electrolyte away from the surface of the substrate, and also has the ability to neutralize the electrolyte if it breeches the vapor barrier and insulation.

Technology

The reactive anti-corrosion gel utilizes mineralization technology. Mineralization is the ability to grow very thin minerals on metal surfaces for useful purposes. The minerals are formed when reactants are delivered to the surface of the substrate as shown in Figure 1.

How the reactive gel corrosion treatment works:

When the ferrous (steel) surface (1) is covered with a layer of reactive gel (2), the metal surface reacts with components in the gel to form a mineral layer (3). This thin, glasslike layer (3) acts as a barrier between chlorides and the metal surface, thus providing corrosion resistance.

The mineral layer (3) has a thickness of 50-200 angstroms, only 0.01 percent as thick as a piece of paper.

Although the thin mineral layer can be damaged by mechanical abuse, there is extra protection built into the system.

The presence and uniqueness of the mineralized layer can be confirmed by conventional analytical surface methods such as X-ray photoelectron spectroscopy (XPS) or atomic force microscope (AFM) (Figure 2 and Figure 3).

The anti-corrosion gel works in three basic ways:

Barrier system – The specially formulated products have great adhesion characteristics and are hydrophobic to help keep moisture away from the substrate.

Buffering system – If moisture migrates through the gel, it is buffered to a high pH which is protective to steel piping.

Mineralization – Growing an engineered surface, or surface conversion – creating a surface which resists corrosion even if moisture gets to it.

The anti-corrosion gel has a maximum service temperature of 350°F (177°C).

Background

The mineralization technology in the anti-corrosion gel has a history of solving unique corrosion problems. The first application of the mineralization technology was by a major automotive supplier in a crevice corrosion application on the strand of brake cables. The strand in sleeve design of the brake cable combined with the cyclical environment of

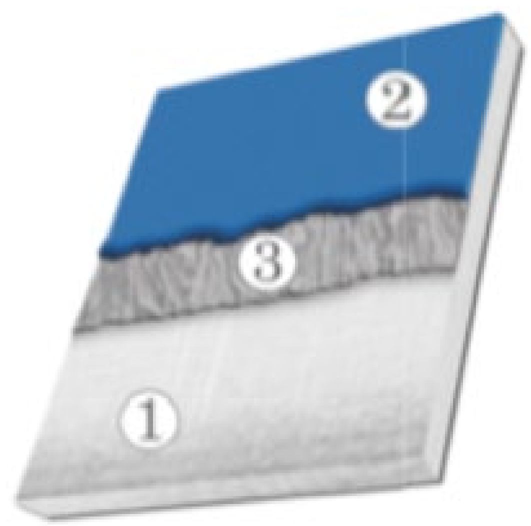

FIGURE 1- Mineral Formation

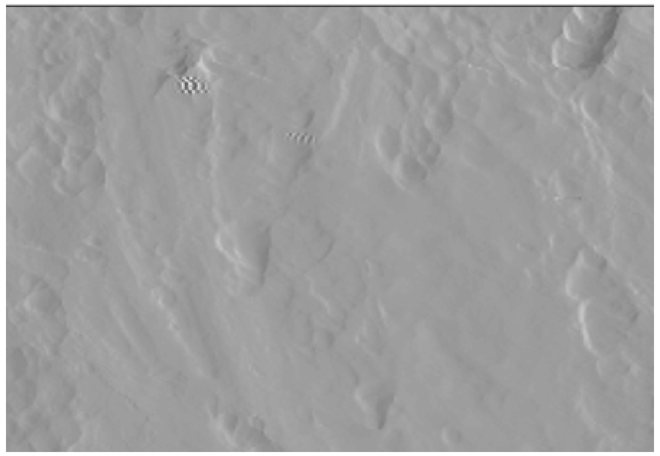

FIGURE 2 – Untreated Steel Surface

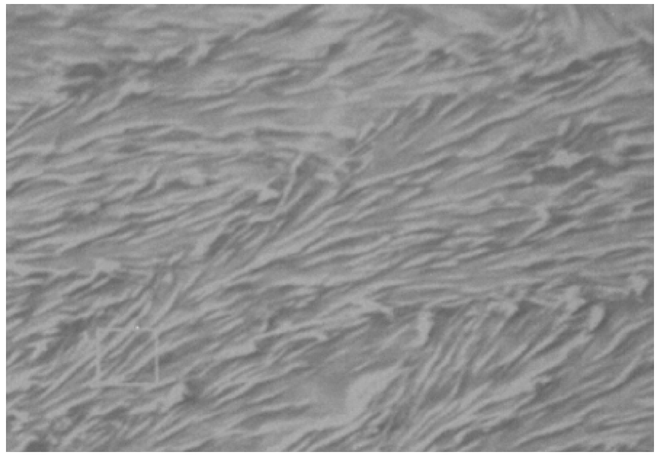

FIGURE 3 – Mineralized Steel Surface

heat and moisture creates a severe crevice corrosion environment. The technology has been used for over 30 years in this application, which has resulted in an increased service life and greater reliability.

The first non-automotive industrial application was with the US Navy. Following successful laboratory, pier side, and shipboard demonstrations of the effectiveness of the gel in preventing crevice corrosion in anchor chain detachable link cavities, the US Navy in 1999 changed the Planned Maintenance System (PMS) to specify the use of a mineralizing gel as the replacement for white lead and tallow in all surface ship anchor chain detachable links. Also in 1999, following extensive testing, the Navy issued MACHALT 526 which changed the design of the internals of weather deck watertight and airtight door dogging mechanisms. The basis for the change is the use of a mineralizing lubricant inside the spindle sleeve in the door frame to stop the corrosion that had been the cause of dogging mechanism failure. The watertight door dogging mechanism corrosion problem was one of the top maintenance issues for the fleet. In May 2002 a second MACHALT, 544, was approved to apply the same technology to ballistic type dogs in three watertight doors in DDG-51 Class ships. These solutions represented a significant savings for the fleet.

The gel has years of history on Corrosion Under Insulation applications in the Food & Beverage Industry. It has also been used as an anti-corrosion coating in well head casings, on pig doors, structural steel, tank chimes, ammonia systems, vessels, and as flange filler. Field trials are currently underway to further evaluate this technology in areas where it is cost prohibitive to achieve optimal surface preparation.

Testing

Aerated Salt Bath: A test was conducted to determine the ability of the anti-corrosion gel to protect pipes in an aerated bath of 5 percent salt solution. Fifteen black iron pipes were used to measure the effectiveness of the gel in conditions similar to CUI. Fourteen pipes were coated with the gel, seven were glass-bead-blasted prior to the application, seven pipes were left as received with mil-scale, and one pipe was left uncoated to act as a control. All of the iron pipes were covered with fiberglass insulation and partially submerged in an aerated bath of 5 percent salt solution. One glass-bead-blasted and non-bead-blasted sample were pulled at 7, 31, 80, 138-day, and 1-year intervals.

The results of tests show a very distinct line separating the sections of the iron pipes that were treated with the anti-corrosion gel and the sections that were left untreated. The untreated pipe sections had significant corrosion at 7, 31, 80, 138-days, and 1-year intervals. There were no sign of corrosion on the coated sections of the pipes. Performance of the gel was good even with minimal surface preparation prior to the application.

Isothermal: One such laboratory test was a simulated CUI cell under isothermal and wet/dry cycling test conditions [2]. The test conditions selected for the research program were (1) isothermal and (2) wet/dry cycling. The isothermal tests included maintaining the temperature at the ring surfaces at 150°F (65.5°C) continuously. The wet/dry tests included two cycles of maintaining temperature at 150°F (65.5°C) (wet) for twenty hours followed by at 250°F (121°C) (dry) for four hours. The samples were evaluated using electrochemical polarization resistance data per ASTM G59 and mass loss (ML) data per ASTM G1. The results of the test were that the anti-corrosion gel reduced the corrosion rate by a factor of ten and was effective in four practical applications: on bare steel at isothermal (isothermal at 150°F, 65.5°C), on pre-corroded steel at isothermal (150°F, 65.5°C) on bare steel in wet/dry environment (150/250°F, 65.5/121°C cyclic), and on pre-corroded steel in wet/dry environment (150/250°F, 65.5/121°C).

Weight Loss: ASTM B117 Salt Spray protocol was used to evaluate the anti-corrosion performance. The ASTM B117 protocol simulates a severe corrosion environment using salt-water spray. The control coupons (bare steel) were tested alongside the coated samples to insure a predictable corrosion rate.

A total of 10 samples (1/2 x 3 x 0.062 inch 1020 steel coupons) were used for this test. The coupons were weighed prior to being coated or being placed in the ASTM B117 cabinet. 5 coupons were coated with approximately 20 mils of gel (Group #1) and 5 coupons were left uncoated to be used as controls (Group #2).

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Specialized Banks Support the Industry

Challenging times make financial understanding more critical.

By Elizabeth Hund, U.S. Bank; Special to Food Processing

It's no secret the past several years have been challenging for the food & beverage industry. Food processors and manufacturers are dealing with tremendous volatility in the commodities market. They face media scrutiny around food safety and have financially strapped customers that are making fewer shopping trips and buying less. These challenges have strained companies' capital resources and slowed their economic growth.

Of the various advisors that food processors work with, banks with in-depth knowledge of the food industry are critical as they have the experience and resources to help food companies overcome these challenges. These banks provide access to capital, help to mitigate the impact of commodity volatility and first-hand understanding of the influence of the global economy on day-to-day operations. They understand the business model, the competitive landscape and how to keep the flow of capital moving.

From the moment a food processor begins production to the time its products make it onto consumers' tables, there are multiple transactions that require capital. Consider, for example, everything that goes into turning whole grains into a loaf of bread and the variety of issues and questions that may arise during that process that can impact a company's costs, such as:

- What happens if raw materials costs or fuel costs rise if new equipment is needed or if government regulations change?
- How will these factors impact a company's ability to get food onto store shelves or to restaurants?

This is when and where an educated banking partner can add value for food processors. Financial institutions understand the volatility in commodity pricing and how it can impact capital needs. They provide equipment leasing options and constantly monitor government regulations that may require production modifications and additional capital resources.

To keep the capital engine moving, food companies need a banking partner that understands how the food industry works and the issues and obstacles that must be monitored and overcome to get products to consumers. With this deep knowledge of the food industry, bankers become valued strategic partners and resources.

Today, more than at any other time in history, what happens around the world has a major impact on the domestic food industry. From the growing demand for protein in China to the bio-fuels market, there are changing world conditions that influence raw materials costs. And large swings in commodity costs driven by these uncontrollable factors directly impact the bottom line.

To manage the volatility, companies need to have the necessary liquidity or access to capital. Banks that focus on food industries are prepared to deal with the demands for capital that will come as a result changing conditions. These financial institutions understand the economic issues relating to food and agriculture and are ready to lead sophisticated discussions and strategy execution. If money does not flow into food companies during volatile times then, at best, things slow down; at worse, everything stops.

One of the major concerns for the food industry is the state of the global economy. Europe, Canada and Japan have become critical banking partners to U.S. industries. Unfortunately, recent European crises have further emphasized the need to have a variety of funding resources, including a strong U.S. partner. A diverse base of financial partners helps reduce the impact on capital resources when there is stress in one segment or region of the financial community.

A banking partner can help prepare these businesses to compete more effectively in the global marketplace, positioning them with capital resources that will help them successfully ride the waves of uncertain times and market conditions.

Every business cares about having access to money. What the banking industry can add to current financial conversations in the food industry is experience with how access to capital is influenced and obtained. Specialized banks can:

- Help forge strategies and serve as advisors to C-level executives to help them plan for future capital needs.
- Identify obstacles in international trade and expansion.
- Build relationships with equipment vendors and service providers.
- Share insights about why parts of the world are experiencing financial crisis while others are struggling to keep pace with prosperity.

Banks have billions of dollars invested in food businesses, and are active participants in the ebb and flow of the industry. More importantly, they want to see their clients succeed. These industry-specific lenders are working to ensure that capital is available at any point along a product's lifecycle to help food companies get their products onto store shelves and into the hands of consumers. FP

Tubular Drag Cable Conveyors Streamline Breakfast Cereal Processing

By Jim McMahon, for Cablevey Conveyors

Whatever the food item – from frozen pizzas to fresh burritos, baked goods to candy, or health bars to processed cheese – the need for transporting food products from initial receipt of raw materials through each process stage in the food production line with high throughput, minimized product damage and a high level of product safety is of critical importance.

Despite utilizing the best processing equipment to manufacture and package food products, if the material handling systems being used for moving these products into and out of the equipment is inefficient then the finished products and throughput volume will be compromised. Yet, too many food manufacturers are plagued with conveying equipment that is not ideally suited to address the needs of their particular food processing and packaging applications.

One industry that is heavily dependent on the use of conveying systems is breakfast cereal manufacturing, where a variety of different conveyor applications, with varying levels of efficiency, have traditionally been utilized to transport cereal products between sequences of processes.

Conveying Challenges in Breakfast Cereal Production

Breakfast cereal processing plants are beset with several critical conveying challenges. One of the most important is ensuring that the finished product, once it has gone through its various processing steps, emerges undamaged before its final packaging. Keeping the clusters, loops, puffs and flakes whole can be a significant challenge, however, given that at the end of most machine processing steps the product falls, it is dropped down onto a conveyor system before being taken to the next process. The idea is to get that product through the processes and into the packaging as gently as possible to avoid breakage.

Breakfast cereal plant managers and plant engineers know that how their product is conveyed during the entire manufacturing process plays an important role in ensuring minimum waste as raw goods are transformed into finished cereal products ready for packaging.

Product contamination is another key issue influencing conveying in breakfast cereal production. In every step of the process, from receipt of raw materials through packaging, precluding any foreign matter from entering the process stream is a critical objective. Traditionally used in cereal processing, bucket elevators and belt conveyors, having an open profile, not only permit the entry of cereal dust and foreign particles into the food stream, but they promulgate and spread dust because of their exposed format. This opens the door to contamination and unwanted spread of allergens.

This problem is particularly evident during product transfer between the coating, drying and packaging operations, where there is exposure to a combination of different ingredients. The importance of the product contamination issue is magnified with increasingly stringent governmental and industry mandates, and consumer demands for maintaining product integrity and safety.

Line changeovers have become a focal issue in breakfast cereal plants relative to both cleanliness and speed of changeovers. Companies are trending more and more wanting to run different product lines within a shift or day. Despite these changeovers, processing plants are expected to maintain stringent levels of sanitary operation. This can be a time-consuming challenge when cleaning conveying systems.

Bucket elevators and belt conveyors are particularly notorious for requiring significant time for cleaning because of their various interlocking components. Every minute spent disassembling a conveyor system for cleaning consumes valuable production time. Yet, if not cleaned properly, that batch of cereal that needs to be discarded in-process because of contamination is lost profit. Or worse, consumers could be negatively impacted, resulting in potential injury, costly recalls and impacted brand reputation. To resolve these issues, cereal processors are charged with administering changeovers as quickly as possible while maintaining 100 percent system cleanliness.

Traditional Systems for Conveying Breakfast Cereal

For decades, open conveyors, such as flat-belt conveyors and bucket elevators, have been the predominant systems used to transport breakfast cereal products through the manufacturing process, from raw materials through packaging. But, because of the limitations of these open conveying systems, cereal processors have gradually moved to utilizing other conveyor types, dominated by closed-system tube conveyors. Like the open conveyors, they each have design strengths and weaknesses. Following is an assessment of the major types of systems being employed in breakfast cereal processing:

Flat-Belt Conveyors – Although this type of conveyor can handle cereal products gently, the product is exposed to ambient contamination, unless covered. The cover, however, collects cereal residue and must be removed and cleaned between runs to reduce the risk of cross contamination, a usually tedious task. The cereal product when introduced onto the conveyor is typically dropped from the processing machine, which produces dust and at that point can cause product damage.

Bucket Elevators – Bucket elevators use a continuous line of buckets, either attached to each other on a rubber belt, or attached by pins to two endless chains running over tracks and driven by sprockets. Centrifugal force throws the cereal out of the buckets into a dis-

charge spout as the buckets pass. This type of conveyor can transport fragile materials with minimized product damage. But the system can be very dusty, as dust is generated when cereal is loaded into the buckets and while the product is being conveyed, resulting in residue build-up which can cause cross-contamination. The excessive dust produced can also open the door for dust explosions.

Pneumatic Conveyors – These systems use air to move cereal from extruder to packaging, by generating air pressure levels that are either above or below the atmospheric pressure. There are two main types of pneumatic conveyors: the dilute phase conveyor and the dense phase conveyor, which differ by rate of speed and pressure. Both of these systems can be set up as a pressure or vacuum system. Pneumatic conveyors enable flexibility, allowing them to reach many multiple destinations with one system. They are also able to convey cereal at very high rates without product breakage, and with minimal dust dissemination. One of the main problems with this type of conveyor is its high power consumption. Pneumatic conveying is the most expensive method for moving cereals.

Auger Conveyors – Known as flexible screw conveyors, they can transport cereals vertically, horizontally and at any angle. They consist of a stainless steel flexible screw enclosed in a rigid steel tube or flexible plastic tube driven by a motor. The enclosed tube rotates around a central shaft, transporting the cereal according to the screw design and rotational direction. When the breakfast cereal reaches the end of the tube it is discharged into the process machine or container for packaging. These conveyors have a throughput of up to 100,000 pounds per hour. Auger conveyors, however, have limitations on how much product they can transport before effecting product breakage, which can be significant. Also, internal cleanliness can be an issue resulting in a cross contamination risk, and the need to disassemble the unit on a regular basis for cleaning.

Aeromechanical Conveyors – A completely enclosed, high-capacity mechanical conveyor that can move breakfast cereal vertically, horizontally and at varying angles. Within a stainless steel tube, a wire rope with evenly spaced discs travels at high speeds, running in sprockets at each end of the conveyor. The high-speed action generates an internal air stream traveling at the same high velocity as the discs. As the cereal is fed in, the air stream aerates, or fluidizes it, and carries it to the packaging outlet, where it is discharged by centrifugal force. The system can move up to 240,000 pounds per hour of cereal. A drawback to this system is that the flow of product can easily become inhibited, causing the conveyor to run without transporting cereal at expected throughput volumes. Downtime is also a factor because the tension on the wire rope needs to be adjusted at regular intervals.

Tubular Drag Chain Conveyor – This conveyor gently moves breakfast cereal through a sealed tube with a drag chain pulled through it on a loop. Solid circular discs (flights) are attached to the chain, which push the cereal through the tube. This system can move up to 80,000 pounds per hour throughput of cereal, and can run under either pressure or vacuum modes. One of the drawbacks to this system is the tendency of the chain to accumulate cereal debris build-up, which poses a cross-contamination risk, so it needs to be regularly removed. Also, the chain-drive components need to be regularly adjusted to keep the system in registration, which increases downtime.

Such traditional conveying systems have only minimally kept pace with the increasingly challenging requirements that breakfast cereal processors are facing. Not to mention corporations' continued push for more cost-efficiency and higher throughput on their processing lines, which is also driving the need for system upgrades in breakfast cereal processing worldwide.

Conveying systems that were installed in breakfast cereal processing plants 10 or 15 years ago incorporating the above systems, at that time may have been adequate, but now better technology in conveying system design, controls and automation has brought into place a whole new generation of conveyors for use in this industry, with resultant vastly improved efficiency. Safer, cleaner processes that reduce waste and deliver cost, labor and energy savings are increasingly being factored into equipment selection. Such conveying systems are having a critical impact on cereal processors' operational costs and plant ROI.

Tubular Drag Cable Conveyors a More Efficient Solution

Embodying these requirements, the tubular drag cable conveyor, developed by Cablevey Conveyors, is fast becoming the system of choice for product movement through all phases of breakfast cereal production. The system gently moves friable cereals through an enclosed tube without the use of air. This latest generation of tubular drag cable conveyors can transport up to 49,000 pounds of breakfast cereal product per hour, at low speed, and with product degradation practically eliminated.

Similar to tubular drag chain conveyors, tubular drag cable conveyors gently move product through a sealed tube, but instead using a patented, coated, flexible stainless steel drag cable pulled through on a loop. Solid circular discs (flights) are attached to the cable, which push the cereal through the tube. The coated cable ensures that no debris accumulates within the strands of the cable, as the cable is totally sealed.

Designed for quick cleaning, quick line changeovers and maximized system uptime, the tubular drag cable conveyor system employs sophisticated cleaning mechanisms to reduce debris build-up. The flexible design of this completely enclosed system keeps contamination out, while enabling it to be cleaned-in-place at multiple points from cereal build-up. For example, an air knife at the product discharge locations in the system automatically releases food particles from the discs and cable. Also, urethane wiper discs attached to the cable eliminate any residual debris from the conveyor system while in progress.

To increase uptime, the system is equipped with a cable self-tensioning device, as different from other conveying methods which require continual adjustments to their mechanical operating systems.

The tubular drag cable conveyor operates on low horsepower, utilizing energy-efficient variable-speed motors of 5 HP or less, effectively consuming minimal power compared to other conveyor systems utilized in breakfast cereal manufacturing. The system's production flow can be adjusted to variable speeds.

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