

HELPING MICRO, SMALL AND MEDIUM ENTERPRISES IN THE DAIRY PROCESSING SECTOR IMPROVE PRODUCTIVITY AND REDUCE POLLUTION

Introduction

Over the past few years, dairy factories at Dakahleya have been facing problems that included high milk spoilage, high salt concentration in the cheese and low cheese production yields. Discharge of whey with high levels of organic material and salt was also a significant source of pollution.

These issues were addressed by the SEAM Programme through the Dairy Processors Development Association (DPDA) in Dakahleya, in a series of Cleaner Production (CP) Clinics. The Clinics had two main parts; a place where factory owners could discuss problems with a dairy sector expert and also, to receive CP information, including findings from previously implemented SEAM demonstration projects.

Projects replicated at the dairy factories that attended the CP Clinics ranged from simple monitoring and quality control to replacement and addition of new equipment. Results of implementation showed that the projects helped factories improve their competitiveness as well as reduce pollution to the environment.

The Factories

The participating factories included units with a daily processing capacity of 3 to 5 tons of raw milk. All factories produced soft white cheese in summer and hard cheese in winter.

Tables 1 and 2 summarise their milk processing and cheese production capacities.

Cleaner Production Opportunities

Improved process control



Measuring the fat content of raw milk

Most of the factories did not have the laboratory equipment needed to monitor raw milk quality and ensure process control.

Milk analysers and pH meters were provided to five factories to allow them to check the quality of incoming raw milk, so that

unacceptable batches could be rejected. The pH meters helped improve both quality control and process-related problems.

Provision of stainless steel draining tables and draining vats

Most factories used wooden tables and drainage vats, increasing the likelihood of product spoilage and subsequent wastage, reducing factory productivity and profits. These were replaced by drainage tables (400 kg capacity) and draining vats (1500 kg capacity) made of stainless steel, a material that is more hygienic, durable and easier to clean than wood.

Replacing traditional cheese vats with mechanical vats



New mechanical vat

In traditional dairy processing factories, the curd cutting and stirring process is usually carried out manually, resulting in poor curd separation, leading to a higher generation of whey

(hence pollution) and lower cheese yields. This was addressed at four factories by the installation of mechanical cheese vats (see Table 2). These were double-walled with an overhead cutting and stirring mechanism, giving an improved curd separation, reduced whey generation and better cheese yields.



Mechanical vat:: cutting knives

Installation of hot water boiler

Many dairy factories in Dakahleya heat the cheese vats directly, using solar (diesel) and butane burners. A solar-fired boiler is more energy efficient as it heats the cheese vats indirectly using hot circulating water. Installation of such a system in one factory completely eliminated the need for bottled butane and kerosene and reduced solar consumption, resulting in reduced operating costs, reduced heat levels in the workplace and reduced particulate emissions in the immediate neighbourhood.



Solar-fired boiler

Cleaner Production Pays

Findings from the CP Clinics held in DPDA had confirmed that the demonstration projects were highly replicable in many Dakahleya MSMEs. The CP interventions implemented at the DPDA member factories in Dakahleya could be broadly classified into two categories.

The first category includes minor modifications at the factories mainly through replacement of old draining tables and vats, focusing on better monitoring and control and improved hygiene for reducing product losses due to contamination.

A 400kg whey draining table leads to the production of around 100kg Domiaty cheese. When wooden draining tables are used, a contaminated product can result, typically for 7 days per month. The contamination problem results in lower quality cheese (reduced selling cost of LE0.5/kg) and a weight loss of around 3.5% during storage. By substituting these for 400kg capacity stainless steel tables, both cheese quality and productivity increase, amounting to LE 77/day (LE539/month).

On the same basis, stainless steel draining vats result in quality and productivity benefits of LE289/day. Table 1 shows the equipment provided to seven dairy factories, along with the associated costs and benefits. The investments were less than LE30,000, with payback times ranging from 4 to 6 months.

The second category of interventions consisted of factory upgrades, focussing primarily on the installation of mechanical vats. These were installed in another four factories (see Table 2), to improve curd and whey separation. Investments for this level of upgrade were in excess of LE30,000. Table 2 briefly describes each of the beneficiary factories, the investments made, benefits and paybacks; which ranged from 6 to 14 months.

With the help of CP Clinics and the research and laboratory facilities at the ICRC at Ain Shams University, a strategy was developed to disseminate CP related information, provide advice to MSMEs and identify CP opportunities that could address both productivity and environment related problems. Here industry associations such as DPDA could play an effective role.

CP projects implemented across 11 dairy factories show how a programmatic approach could be used to retrofit factories to improve profitability and reduce pollution, all at moderate investment with paybacks ranging between four to fourteen months.

More Information

List of referenced SEAM documents:

- ▶ A Guide for Cleaner Production Opportunity Assessments in SMEs.
- ▶ Case study: "CP Clinics to promote Cleaner Production (CP) in the dairy sector, Dakahleya, Egypt".

- ▶ Case study: "Institutionalising Cleaner Production: Establishing an Industrial Counselling and Research Centre at Ain Shams University".

Further information can be obtained from the Egyptian Environmental Affairs Agency. Additional Cleaner Production information can be downloaded from the SEAM website: <http://www.seamegypt.org>

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SEAM Programme

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SEAM: Cleaner Production

- Small to Medium Size Enterprises (SMEs): SEAM has undertaken over 100 rapid Cleaner Production Opportunity Assessments (CPOA) in SMEs and implemented 30 demonstration projects.
- Medium to Large firms: SEAM has carried out industrial audits in 32 factories in the textiles, food and oil and soap sectors and implemented 23 demonstration projects.
- Guidelines for conducting CPOAs, case studies, guidance manuals and sector assessments are available from the SEAM website.

Benefits of Cleaner Production

- Cleaner Production assessments systematically review the factory's operations and processes, focusing on reducing wastage, improving efficiency and reducing pollution.
- It can REDUCE: production costs, losses of valuable raw materials, on site treatment costs, energy and water costs, the volume of solid and liquid waste generated, and the risk of spills and accidents.
-and IMPROVE: productivity, income from financial savings and reuse of waste, employee safety, legislative compliance and company image.

Table 1: Monitoring equipment, Draining Tables and Draining Vats (investments less than LE30,000)

Factory	Equipment Provided	Cost (LE)	Payback
<p>Abdel Hameed El Adl has been in business since 1973. The factory receives and processes about 6 tons of milk per day to produce 1.5 tons/d of high salt Domiaty cheese in winter season. In the summer season, 2 tons of milk is processed to produce Domiaty cheese.</p>	Stainless steel draining vats (for Domiaty cheese, 2 Nos. with 1500 kg capacity each)	15,000	< 4 months
	milk analyser	11,000	
	pH meter	3,500	
	Total cost, LE	29,500	
<p>Mohamed Saleh has been in business since the 1960s. He receives and processes about 4 tons of milk per day to high salt Domiaty cheese in winter season using traditional equipment. In summer season, the amount of milk decreased to about 1 ton of milk. One ton per day of Domiaty cheese (soft white cheese) is produced in the winter season.</p>	Stainless steel draining vats (for Domiaty cheese, 1 No with 1500 kg capacity)	7,500	< 4 months
<p>Mohsen Shaalan has been in business since the 1960. He receives and processes about 4 tons of milk per day to high salt Domiaty cheese in the winter season using traditional equipment. In summer season, the amount of milk decreased to about 1 ton of milk. One ton per day of Domiaty cheese (soft white cheese) is produced in the winter season.</p>	Stainless steel draining vats (for Domiaty cheese, 2 Nos. with 1500 kg capacity)	15,000	< 4 months
<p>Mohamed Atwa has been in business since 1995. He receives and processes about 2 tons of milk per day to high salt Domiaty cheese in winter season using traditional equipment. In the summer season, the amount of milk decreased to about half ton of milk. 550 kg /day of Domiaty cheese (soft white cheese) is produced in winter season.</p>	Stainless steel draining tables (2 Nos. with 400 kg capacity each)	6,000	< 6 months
<p>Hamed Atwa has been in business since 1944. He receives and processes about 1.5 tons of milk per day to high salt Domiaty cheese in winter season using traditional equipment. In the summer season, the amount of milk decreased to about 1 ton of milk. 400 kg /day of Domiaty cheese (soft white cheese) is produced in winter season.</p>	Stainless steel draining tables (2 Nos. with 400 kg capacity each)	6,000	< 6 months
<p>Atia El Benawy has been in business since the 1990. He receives and processes about 4 tons of milk per day to high salt Domiaty cheese in winter season using traditional equipment. In summer season, the amount of milk decreased to about 1 ton of milk. One ton per day of Domiaty cheese (soft white cheese) is produced in winter season.</p>	Stainless steel draining tables (4 Nos. with 400 kg capacity each)	12,000	< 6 months
<p>Osman Abdel Haleem has been in business since the 1962. He receives and processes about 4 tons of milk per day to high salt Domiaty cheese in winter season using traditional equipment. In summer season, the amount of milk decreased to about 1 ton of milk. One ton per day of Domiaty cheese (soft white cheese) is produced in winter season.</p>	Stainless steel draining tables (4 Nos. with 400 kg capacity each)	12,000	< 6 months

Table 2: Mechanical Vats (supported by monitoring equipment, draining tables/draining vats, hot water boiler)

Factory	Equipment Provided	Cost (LE)	Benefit	Payback
<p>Kamal Samak has been in business since 1958. . He receives and processes about 6 tons of milk per day to Roumy cheese and high salt Domiaty cheese in winter season using traditional equipment. In the summer season, 3 tons of milk is processed to produce Domiaty cheese. In the winter, 300 kg /day of Roumy cheese (hard cheese) and 750 kg /day of Domiaty (soft white cheese) are produced.</p>	milk storage tank (3 ton capacity)	30,000	<p>A 3% increase in the production of Roumy cheese gave savings of about LE4800 per month (including losses due to reduction in production of whey cream). Improvement in quality of Domiaty cheese saved about LE4046 per month. These benefits led to a net saving of LE 82,152 on an annual basis considering 7 months of Roumy cheese and 12 months of Domiaty cheese production.</p> <p>Other significant benefits: a reduction in whey pollution load (15% reduction in BOD/COD; 30% reduction in salt in whey).</p>	< 14 months
	milk analyser	11,000		
	draining vats (Nos. 2)	15,000		
	mechanical vat	35,000		
	Capital cost, LE	91,000		
<p>Gehad El Halawany has been in business since the 1945. The factory receives and processes about 5 tons of milk per day to Roumy cheese in winter season. In summer season, 3 ton of milk is processed to high salt Domiaty cheese. In the winter, 500 kg /day of Roumy cheese (hard cheese) and in the summer 800 kg /day of Domiaty (soft white cheese) are produced.</p>	draining vats (Nos. 2)	15,000	<p>Productivity of Roumy cheese was increased by 17 kg (3.11%) leading to around LE272 of additional income each day (the improved yield of cheese, reduced the yield of whey cream by 5 kg/day. This lead to a marginal daily loss of income of LE47). Fuel consumption was reduced by 50 litres (44.4%) leading to a daily saving of LE30.</p> <p>Although the volume of whey discharged remained the same, its pollution load decreased. BOD and COD were reduced in Roumy cheese season by 15%.</p>	< 12 months
	pH meter	3,500		
	milk analyser	11,000		
	water boiler	33,000		
	mechanical vat	35,000		
	Capital cost, LE	97,500		
<p>El Zohairy has been in business since 1950. The factory receives and processes about 5 tons of milk per day in winter season to produce 500 kg of Roumy cheese. In summer season, 1 ton of milk is processed to produce 250 kg of high salt Domiaty cheese.</p>	milk analyser	11,000	<p>A 3.11% increase in the production of Roumy cheese giving savings of about LE272 per day. Other intangible but significant benefits included reduction in the air emissions, reduction in the pollution load in the whey.</p>	< 6 months
	mechanical vat	35,000		
	Capital cost, LE	46,000		
<p>Shehab has been in business recently since 1986. The factory receives and processes about 3 tons of milk per day to produce 300 kg/d of Roumy cheese in winter season. In summer season, 2 ton of milk is processed to produce 500 kg/d of Domiaty cheese.</p>	pH meter	3,500	<p>A 3% increase in the production of Roumy cheese giving savings of about LE4800 per month (including losses due to reduction in production of whey cream). These benefits led to a net saving of LE4800 on a monthly basis.</p> <p>Other significant benefits included reduction in the pollution load in the whey (15% reduction in BOD/COD and 30% reduction in salt in whey).</p>	< 8 months
	mechanical vat	35,000		