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Regional Activity Centre for Cleaner Production

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No. 32 Pollution prevention case studies

Industrial pollution prevention in the oil and soap sector

Company background	Sila Edible Oil Company (Fayoum, Egypt) processes and average of 68,000 t/y of seeds, mainly sunflower, corn, soybean and cotton, producing up to 24,000 t/y of first grade edible oil. The main by-products include around 40,000 t/y of dried meal (packaged in sacks and sold as animal feed) and approximately 1,800 t/y of soapstock and gums (separated by highspeed centrifuge).
Industrial sector	Oil and soap sector.
Environmental considerations	Oil processing in the company is carried out in 5 main steps: - Seed reception, separation of the broken seeds and storage. - Seed preparation and oil extraction. 50% of the crude oil content is extracted by using expellers and a seed cake containing around 30% oil is obtained. - Solvent extraction. The seed cake is sent to the solvent extraction unit (with hexane) where a solvent-oil mixture (miscella) and an extracted meal (2% oil content) are generated. Crude oil is extracted from miscella by a 3-stage evaporation system. The extracted meal is also desolventised and then toasted, dried and cooled. The hexane is recovered within the system and reused. - Refining of crude oil, which is degummed, neutralised with caustic soda (to remove fatty acids to generate soap stock), washed, separated by centrifuge and deodorised. - Packaging of primary oil and bottling.
Background	By means of an industrial audit of the company carried out by the SEAM Project, the following pollution prevention opportunities were initially identified: 1. Reduction of steam losses as a result of damaged lines and valves and inadequate insulation. 2. Reuse of broken seeds and hulls in the oil extraction process in the seed-receiving unit. 3. Reduction of mazout leaks and spills. 4. Segregation and reuse of the refinery wastewater, which has the highest organic load. 5. Reduction of oil losses in the refinery due to leakage, in the storage unit and in the packaging area and losses of process chemicals in the refinery unit.
Summary of actions	The following measures were put into practice, thus enabling a reduction in treatment: 1. Good housekeeping: • Preventive Maintenance Programme (in-factory servicing of the expeller, modification of the packing of the cooling towers and steam trap modifications, repair of leaking or broken valves, damaged water pipes and damaged steam pipes, etc.). • Collection and recycling of split oil in the packaging unit, pumping it to a collection tank, where the oil is recycled to the refinery for reprocessing.

2. Process modification:
- Reuse of fines from the preparation unit. The plant was originally designed to recycle sunflower seed fines back to the expeller. This step was modified to direct these fines immediately to the extraction plant, allowing a higher throughput of fresh seed in the expeller.

3. Material substitution:
- Use of caustic soda solution instead of caustic soda when neutralising. Thus losses of caustic soda are reduced.

4. Water and energy conservation:
- Upgrade steam network, rehabilitating the steam lines, tuning the boiler and improving the treatment of boiler feedwater, recycling the steam condensate, replacing faulty/broken valves, replacing/repairing steam traps and pipes and insulating hot water and steam pipes.

5. Reuse and recycling:
- Recovery of hulls and broken seeds. They were originally collected and sold as animal feed. The process has now been modified so that they are collected using a screw conveyor and transferred to the preparation unit, where they are further processed.
- Recovery of 10% of fatty matter from the final effluent. Fat is collected from the refinery effluent by a scraper, acidulated, split and then transferred to soapstock storage tanks.

6. Wastewater segregation:
- Segregating of process effluents coming from the refinery. The remaining effluent produced by the company is used for land reclamation activities within the factory.

Balances

Options	Benefits	Savings (t/year)	Investment (€)	Savings (€ /year)	Payback period (months)
Preventive Maintenance Programme	Reduction of steam and warm water losses and process optimization	34	4,500	9,000	6
Oil recycling	Further production	13.92	750	10,500	< 1
Reuse of fines	Crushing capacity has been increased	120	3,000	36,000	1
Use of liquid caustic soda	Daily neutralisation costs dropped by 47%, reduced losses of caustic soda, reduced levels of corrosion, improved soapstock quality, better working conditions		None	75,000	Immediate
Upgrade steam network	Steam consumption reduction	3,600	9,000	165,888	< 1
	One boiler has been taken off the line (savings of mazout usage)	1,728			
	Water consumption and maintenance costs reduction	28,800			
Recovery of broken seeds	Extra of oil	78	2,700	138,975	< 1
	Extra of meal produced	595			
Fat recovery	Recovery of soapstock and reduced strength of wastewater	29	1,500	4,320	4
Wastewater segregation	Reduction of effluent to be disposed of off-site	13,464	None	5,400	Immediate

Conclusions

With the implementation of these low or no-cost measures, the company achieved significant benefits. Maintenance costs were reduced by 10%, water consumption was reduced by 46%, wastewater treatment requirements were reduced by 66%, boiler fuel consumption was reduced by 48%, annual recovery of oil, soapstock and meal was valued at €207,795, and the company achieved discharge compliance.

NOTE: This case study seeks only to illustrate a pollution prevention example and should not be taken as a general recommendation.

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