POLICY BRIEF

June 2017
The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

Water and wastewater management in the edible oil industry (2nd edition)

The Water Research Commission completed the second national survey (NATSURV) on water and waste management in the edible oil sector. Despite low participation from edible oil manufacturers the study was able to provide various recommendations on improving water and wastewater management in the industry.

Background

This WRC study focused on the water and waste management of the edible oil industry. The study forms part of a series of WRC national surveys (NATSURVs) on the water and wastewater practices of industries in South Africa. Previous surveys were undertaken between 1986 and 2001, and much has changed since then. The new edition NATSURVs provide recent and relevant information on water, wastewater and energy management practices to all stakeholders involved in the chosen industries.

The edible oil production landscape in South Africa has changed considerably since the publication of the first NATSURV in 1989, when sunflower seeds, groundnuts and maize were seen as major contributors.

Since then, canola oil has emerged as a significant agri-industrial product. Canola was first planted in South Africa in the early 1990s. Since then, production of Canola seed has risen steadily to 126 000 metric tons in 2014/15. In addition, the local olive oil industry has grown significantly. It is estimated that around 2 000 metric tons of olives are processed for oil production annually.

South Africa is one of the largest producers of avocado oil in the world, with around 100 metric tons of refined avocado oil per annum being produced at the country's largest facility. About 13% oil can be extracted from avocados, with a further 2% loss during refining.

Most of the 17 seed and/or palm oil processing facilities in South Africa are located in Gauteng (>50%), followed by KwaZulu-Natal and the Western Cape.

Water use

Significant volumes of water in the form of process water, steam, and cooling water are required for edible oil production. In addition, water is used to clean the equipment and floors.

In the 1st edition, the specific water intake (SWI) was calculated from one edible oil processing facility. Although this figure is dated, it still compares favourably with more current literature values.

There seems to be a downward trend in the SWI from the previous NATSURV (see Table 1 below), but there is insufficient data from either of the surveys to ascertain whether this is statistically significant.

	Cooling water (m^3/MT oil)	Neutralisation (m^3/MT oil)	Deodorising (m^3/MT oil)	Degumming	Reference (m^3/MT oil)
Benchmark	2-14	1-1.5	10-30	NG	IFC, 2015
Natsurv 2016	NG	0.1	0.18	5.8×10^{-2}	NATSURV, 2016

Table 1: Specific water intakes - benchmarks and/or South African values for cooling water, neutralisation, deodorising, and degumming

All seed oil respondents use mainly potable municipal water. Only one professed to have water use reduction targets in place. However, this facility could not provide any water figures. Regarding 'unnecessary' water use, one respondent identified that large volumes of water are being used to dampen boiler ash.

In South Africa, three-phase extraction is used for olive oil processing, so water is only used for washing the olives before processing, and washing equipment and floors after use. One olive oil facility uses borehole water and another harvested rainwater.

These facilities each produce less than 12 metric tons of oil/year, and estimate that the SWI is around 0.02 kL/ton.

Wastewater generation

In edible oil facilities, the wastewater emanates from oil extraction and refining as well as general cleaning activities (spills, truck wash-bays and equipment). In modern facilities, with sound equipment maintenance protocols and cleaning-in-place machinery, wastewater generation from non-processing activities can be minimized.

The water used in the pre-treatment and extraction processes is in the form of steam, most of which is re-captured in cooling towers. The refinery is the major contributor to the wastewater burden in terms of effluent quality and quantity.

Wastewater quantification and characterisation

In South Africa, effluent from the seed-oil industry is discharged to sewer. Refining typically accounts for more wastewater generation than pressing or extraction. Cooling water can account for large volumes of wastewater, which can be minimised by effective recirculation. In this survey, only two respondents provided wastewater figures. While these compare favourably with literature values (see Table 2 below), this does not necessarily reflect the South African industry at large.

Typically, wastewater quality is monitored on a regular basis in-house. In addition, the local municipalities take grab samples for testing at random or scheduled intervals.

Some wastewater quality data for different processes have been published and snapshot samples were taken by the project team from different areas at one edible oil facility. It is clear that some waste streams are highly contaminated, while others may be considered for reuse.

Oil type	Process/es	Specific effluent volume	Reference
Seed (not defined)	Extraction, refining	2.0 m^3/MT oil	NATSURV, 1987
Seed (not defined)	Extraction, refining	2.7 m^3/MT oil	SEAM report, 1999
Rapeseed – crude	Extraction	7-12 m^3/m^3 oil	AWARENET,2002
Rapeseed – refined	Extraction, refining	10-12 m^3/m^3 oil	AWARENET,2002
Vegetable – crude	NG	0.2-0.5 m^3/m^3 seed 0.2-14 m^3/m^3 seed**	CIAA-FEDOIL, 2002 BMU, 2002
Vegetable – refined	Refining – soap splitting	1-1.5 m^3/MT oil	CIAA-FEDOIL, 2002 BMU, 2002
Vegetable – refined	Refining – cleaning	≤ 0.5 m^3/MT oil	CIAA-FEDOIL, 2002 BMU, 2002
Vegetable – refined	Refining – deodorisation condensate	0.01-0.1 m^3/MT oil	CIAA-FEDOIL, 2002 BMU, 2002
Vegetable – refined	Refining – deodoriser condensate with steam ejection	0.02-0.04 m^3/MT oil	CIAA-FEDOIL, 2002 BMU, 2002
Vegetable – refined	Refining – Distillation neutralisation and deodorisation. No recirculation	10-30 m^3/MT oil	CIAA-FEDOIL, 2002 BMU, 2002
Seed – crude	Solvent extraction	0.3 m^3/MT oil	NATSURV, 2016
Seed – refined	Physical refining, value added	0.1 m^3/m^3 oil	NATSURV, 2016
Seed – refined	Neutralisation	0.07 m^3/MT oil	NATSURV, 2016
Seed – refined	Soap splitting	0.03-0.05 m^3/MT oil	NATSURV, 2016
Seed	Condensate from neutralisation	0.03-0.08 m^3/MT oil	NATSURV, 2016
Seed – refined	Chemical refining	0.15 m^3/MT oil	NATSURV, 2016

NG = not given ****cooling water waste**

Table 2: Local and global quantitative wastewater generation data

Ideally, best practice pollution prevention measures should be applied within the facility to limit effluent contamination and the need for intensive wastewater treatment. The respondents from the olive and avocado oil producers indicated that they used the wastewater for beneficial irrigation.

To order the report, *Natsurv 6: Water and wastewater management in the edible oil industry (Edition 2)* (**Report No. TT 702/16**), contact Publications at Tel: (012) 761 9300, Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.