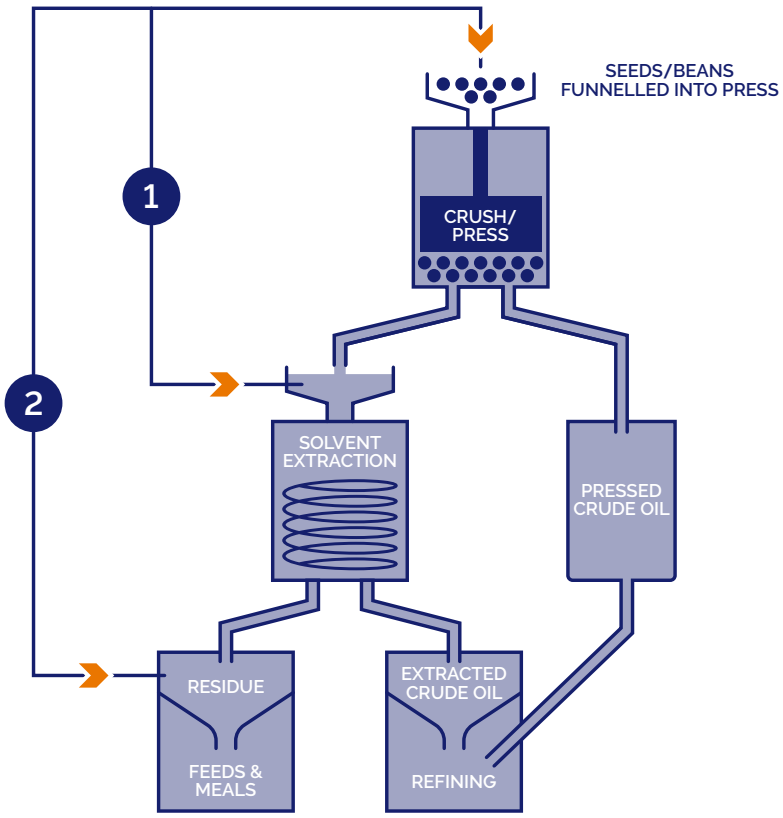
A cost benefit analysis:

Optimising seed oil yield by in-process testing using MQC+ Oilseed Analyser

Vegetable oils have a variety of uses which include for cooking, as food ingredients, in margarine and shortening manufacture, and use as biofuels. They are produced by crushing and solvent extraction from oilseeds.

The price and oil content of the oilseeds from which the oils are extracted can vary due to many factors, including the quality of the harvest. However, the final oil yield is also affected by the efficiency of the extraction process, which can be monitored by measuring the oil content of the incoming oilseed and comparing with the oil content of the residues after pressing and after solvent extraction, as illustrated in the diagram below.

Sampling points for oil and water measurements required to improve seed oil yield



Suitable point for oil and water content measurement

1 Measures pressing efficiency

2 Measures total extraction efficiency

Introducing the MQC+

The **MQC+** oilseeds analyser accurately measures the oil and water content of both oilseeds and residues according to ISO 10565 and ISO 10632 standard methods respectively. The NMR measurement is based on a simple and intuitive linear calibration that is unaffected by granularity, colour, or the origin of the seeds. Therefore, any decisions based on the oil content measurement, including crushing process optimisation, can be taken with confidence.

Furthermore, the **MQC+** oilseed analyser can also measure the oil content of the processed oilseed meal which is subsequently used for animal feed.

Simple and transparent calibration

The **MQC+** oilseed analyser requires calibration using a minimum of three samples; a global calibration based on 100's of samples is not required, so additional costs for calibration maintenance are also avoided. After the initial calibration, stable synthetic samples are used to recreate the calibration in the long term.

Increased productivity

If Soxhlet extraction methods are used, it normally takes around one hour for a laboratory technician to prepare six samples for analysis, including cleaning afterwards (10 minutes labour per sample). It then takes an additional two hours for the extraction to take place, limiting one automated extraction system to the analysis of 18 samples during a daytime shift.

The MQC+ software is designed with ergonomics in mind, such that samples may be repeatedly weighed then analysed without needing to use the keyboard and mouse. The sample is poured into a tared tube, automatically weighed then placed in the instrument and analysed. The measurement takes just 16 seconds for the ISO methods. It takes only 2-3 minutes to prepare and analyse each oilseed or residue sample, therefore the **MQC+ can analyse in excess of 250 oilseed samples per day** as would be required during the harvest season.

Reduced material costs

Although a lesser cost per sample than the labour cost, solvent usage and disposal costs can be significant for Soxhlet analysis. Typically, each sample requires 50ml of petroleum ether at a cost of $20 per litre, so over the course of a year this can equate to:

18 samples/day x 365 days x $20 x 50/1000 L = $6,570 per year

Furthermore, assuming disposal costs equate to 20% of the solvent costs, that makes an **estimated solvent cost for the Soxhlet extraction method of $7,884 per year.**

The **MQC+** does not use solvents or any other consumables, just a mains power supply, and the glass tubes supplied with the instrument may be reused.

Process efficiency

In addition to improving laboratory efficiency, rapid and accurate oil measurement provides the data required to maximise oil yield. For example, if a rapeseed crushing plant producing 100,000 metric tonnes of oil per year were able to increase their yield by 0.1% by process optimisation based on the oil content measurement, then the NMR instrument would more than pay for itself within a year of operation (assuming a market price of $800 dollars per metric tonne).

Practical and financial comparison of Soxhlet and MQC+ oilseed analysis

	Soxhlet Extraction	MQC+ Oilseed Analyser
Standard ISO method(s)	Yes	Yes
Daily sample throughput	18	>250
Annual solvent costs	$6,570	$0
Annual solvent disposal costs	$1,314	$0
Annual yield improvement value	Not applicable	$80,000

Conclusion

In comparison to Soxhlet extraction methods, the MQC+ improves the analysis of oilseeds and their residues in three ways:

- Improved productivity and/or reduced labour costs
- Reduced consumable costs
- Improved crushing yield due to a timely and accurate response

In comparison to near infra-red analysis, the MQC+ provides:

- A simpler and intuitive calibration process, independent of the physical properties and origin of the sample
- No additional costs of calibration maintenance
- Improved crushing yield owing to more accurate measurements

If you have any questions about this article, please contact our experts: magres@oxinst.com

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