Literatures showing some limitations of Soxhlet Hexane Extraction

Research showing use of enzymes to breakdown cell-walls of various type of oil cells and subsequently performing hexane soxhlet extraction. Higher oil yield was observed when enzymes were added. Similarly, SPEC also helps to breakdown the oil cell walls and release more oil

efficient in other oilseeds oil extraction process. It has been reported that extraction yield can be increased by using enzymes which degrade the oilseed cell wall components, facilitating oil release. Oil extraction improvement may be caused by enzymatic breakdown of the cell wall coats and a partial decomposition of matter fibres, thereby favouring the oil flow (Zuniga *et al.*, 2003).

Studies have been reported on the use of this technique on a wide range of oilseeds: shea, olive, coconut, cocoa, hazelnut, soya bean (Fullbrook, 1983; Buenrostro & Lopez-Munguia, 1986; McGlone *et al.*, 1986; Graille *et al.*, 1988; Sosulski *et al.*, 1988; Sosulski & Sosulski, 1993; Smith *et al.*, 1993; Tano-Debrah & Ohta, 1994, 1995a, 1995b, 1997; Tano-Debrah *et al.*, 1994; Rosenthal *et al.*, 2001; Zuniga *et al.*, 2003), but nothing has been done on *R. heudelotii* seeds.

Source:

Enzyme-assisted hexane extraction of Ricinodendron heudelotii (Bail.) Pierre ex Pax seeds oil **By Dandjouma ,A.K.A, et Al.,** International Journal of Food Science and Technology 2008, 43, 1169–1175

Research showing use of enzymes to breakdown cell-walls of various type of oil cells and reduce oil losses in palm oil.
Various other sources of research also showed different oil cells treated with enzymes before soxhlet extraction gave higher oil yield

In relation to the pressing process, Cheah *et al.*[43] extracted 97.7% of the oil from the pectinase-treated mesocarp of palm by using a hydraulic press compared to 91.1% obtained from the untreated material. In the same way, Bouvier and Entressangles[44] used a cellulase preparation to reduce by 3% and 18%, respectively, the palm oil losses from press fibers and crude juice during clarification compared with the traditional process without use of enzymes.

Source:

Aqueous and enzymatic processes edible oil extraction By Rosenthal, A., et Al., Enzyme and Microbial Technology 19:402-420, 1996

Research paper where it was shown higher Oil yield was observed using cold extraction and reflux methods with hexane solvent compared to soxhlet extraction

Table 1. Oil recovered from palm pressed fiber via various extraction methods

	Cold extraction	Soxhlet	Reflux
Physical	Powdered	Powdered	Powdered
Extraction time	8 hours	8 hours	8 hours
Sample: Solvent	1:5	1:5	1:5
Oil yield, %	4.35	3.78	4.94

Source:

Palm pressed fibre oil: A new opportunity for premium hardstock?

By Neoh, B.K., et Al., *International Food Research Journal 18: 769-773 (2011)* **2011**

Research thesis's that showed that different solvents may have better efficiencies compared to hexane

4.0 CONCLUSIONS

1. It is found that *n*-heptane is the most effective solvent following by *n*-hexane and *n*-pentane in the extracting of palm oil form POME.
2. The % of extracted oil from POME increases with the increase of mixing time, solvent/feed ratio, and mixing rate for all solvents.
3. The % of extracted oil increase with the increase of the number of stages. Almost 99% of oil was extracted at the 4^{th} stage using *n*-heptane while 91 and 93% were obtained using *n*-pentane and *n*-hexane, respectively.

Source:

Removal of Residual Oil from Palm Oill Mill Effluent Using Solvent Extraction Method By Hameed, B. H., et al., *Jurnal Teknologi, 38(F) Jun. 2003: 33–42* **University Teknologi Malaysia**

was determined as 12 hours. Four different solvents were used to extract the residue oil from the waste samples. The results shows that the percentage of oil extracted from Methyl ethyl ketone and acetone was high compared to hexane and petroleum ether. The iodine value was also determined to compare the quality of the oil

Source:

Oil Recovery by Palm Oil Waste By Dashiny , G, Research Thesis, University Malaysia Pahang

Lab Test on Oil Losses at Heavy Phase

Soxhlet hexane extraction was performed on July 2, 2011 of 3 samples of heavy phase. One set was dosed with SPEC and another control, without SPEC.
Lab test was done to show that hexane extraction have limitations and not all of the oil content are shown.

	SPEC	Control (No SPEC)
	0.79	0.76
	0.99	0.72
	0.6	0.73
Average	0.79	0.74

- Results show that samples dosed with SPEC have higher oil content as SPEC works to break emulsion and free oil from the oil cells

Conclusion:

Soxhlet extraction using hexane is the best option available in the Palm Oil Mills considering factors such as safety, cost and efficiencies. However, this method is not perfect and does not show all oil