

## OIL EXPRESSION OF RAPESEED WITH TWIN -SCREW EXPELLER

S.ISOBE, F. ZUBER, K. UEMURA AND A. NOGUCHI

National Food Research Institute,2-1-2 Kannondai Tsukuba Ibaraki 305 Japan

INTRODUCTION

Oils from seeds such as rapeseed, sunflower and sesame are currently expelled with single screw expellers and then, if necessary, the remaining oil is extracted by organic solvents. In existing single screw expellers, material transportation depends mainly on friction which sometimes causes excess frictional heat, large energy consumption and oil deterioration. Furthermore, single screw expellers have inadequate crushing and mixing abilities.

A twin-screw type can be expected to solve these problems because of higher transportation and better mixing and crushing functions at the twin screw interface. Results of oil expelling from rapeseed using a twin-screw expeller will be discussed.

MATERIAL AND METHODS

A twin-screw expeller (screw diameter=136mm,L/D=6.5) was designed to have partial intermeshing and counter-rotating twin screws<sup>1)</sup>. Whole raw rapeseed (Canola:water=7.94%, oil=40.70%), cooked rapeseed (water=3.95%, oil=42.94%) and flaked rapeseed(water=8.18%, oil=39.98%) were expelled using twin-screw expeller, and crude oil and presscake were sampled. Operating conditions (barrel temperature, barrel pressure, feed rate) were measured. The oil content of crude oil and presscake were analyzed by Soxhlet extraction and then oil recovery efficiency was calculated. Oil qualities (water, foreign material, acid value, phosphorus) were analyzed by the Japan Oil Chemical Society's standard methods<sup>2)</sup>. The same parameters (oil recovery efficiency and oil qualities) from commercial oil expression of rapeseed were supplied by TOYO Oil Milling co. in Japan. This commercial process has pretreatments before expelling (flaking and cooking) and uses single screw expelling(feed rate 7500kg/h).

RESULTS AND DISCUSSION

Table 1 shows the operating conditions for each process. The twin screw expeller's barrel temperature was lower than the single screw expeller's, especially with whole raw rapeseed. Even the outlet barrel temperature is about 70 °C compared to 93 °C for the single screw outlet. These results indicate that the twin screw expeller didn't generate as high of a shearing heat energy, so that low temperature processing to get good quality oil could be done with the twin screw expeller. Also, pressure in the barrel was relatively low, resulting in little foreign material in the crude oil(Table 2).

Table 2 shows oil recoveries and oil qualities. Oil recoveries with the twin screw expeller were in no way inferior to the commercial one even for whole raw rapeseed. This means that the twin screw expeller has good crushing and mixing ability. Acid value and phosphorus content were lower than that of commercial oil, especially for rapeseed that was not flaked. Phosphorus contents were one-fourth of the commercial values. Low phosphorus oils are a result of no pretreatment and a short time, low temperature expelling that precludes hydrolysis of phosphatides by phospholipase. Low phosphorus oil has merit in that oil loss during the degumming and refining process would be reduced.

#### CONCLUSION

Oil expelling with a twin screw expeller has several good points. It is a low energy consumption process not requiring seed pretreatment. There is little frictional heat generated and oil recovery is high. Good quality oil, especially with low phosphorus content is recovered.

In the future, We will examine the scale-up of this twin screw expeller for commercial use.

#### REFERENCES

- 1)S.ISOBE et al, A new twin screw expeller design for extraction (submitted to JAOCs)
- 2)Standard oil analysis methods, Japan oil chemical society(1982)

Table 1. Operating Condition

Expeller	Rapeseed Type	Feed Rate (kg/h)	Barrel temperature		Pressure in the barrel (MPa)
			Inlet	Outlet (°C)	
Twin screw	Whole raw	9 0	3 2. 4	7 3. 7	3. 8
Twin screw	Whole dry	9 0	4 3. 9	8 9. 0	0. 9
Twin screw	Flaked	5 4	-	-	0. 3
Single screw*	Flaked & Cooked	7 5 0 0	1 0 5	9 3	-

\* commercial process

Table 2. Oil recovery and quality

Rapeseed type	Oil recovery (%)	O i l      q u a l i t y			
		Water (%)	Foreign material (%)	Acid Value	Phosphorus (ppm)
Whole raw	7 1. 0	0. 6 7	0. 7 2	1. 1 2	3 7
Whole dry	8 1. 0	0. 6 9	0. 9 5	1. 1 2	1 1 6
Flaked	7 0. 5	0. 7 0	2. 0 0	2. 5 6	1 3 4
Flaked & cooked*	7 1. 1	0. 9 8	-	2. 3 1	4 7 5

\* Commercial process