INFLUENCE OF MOISTURE CONTENT AND AIR PRESSURE ON THE DEHULLING EFFICIENCY OF SUNFLOWER HYBRID „KOLOS" ON THE LABORATORY „AIR-JET" IMPACT DEHULLER

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ABSTRACT

The method of response surfaces was used for optimizing of Yugoslav sunflowerseed hybrid KOLOS dehulling. The moisture content of the seed and air pressure in the laboratory air-jet impact dehuller were varied during the experiment. By statistical analysis of the results a functional dependence between the factors investigated and the dehulling efficiency was found.

INTRODUCTION

In the production of sunflowerseed protein products (flour, concentrat, isolate) the starting material - dehulled seeds - should contain less than 3%of hull (Trachino et al., 1984). However, it is very hard to achieve such low values. One of the possible solutions is the selection of seeds with more favorable dehulling characteristics (Briffaud et al., 1986). Another possibility is the optimizing of this process both from technical and technological aspect (Goldovskij, 1970, Turkulov et al., 1988). The method of response surfaces offers the opportunity for the easier resolving of optimizing of technological processes (Walker and Parkhurst, 1984). The optimizing of KOLOS hybrid dehulling is presented in this work, using this methodology. As the result of experiments, we obtained the necessary informations on the specificity of this hybrid, which can be used for later selection.

MATERIALS AND METHODS

Materials. The sunflowerseed KOLOS used for the experiments, was obtained from the Institute for agriculture in Zaječar (Yugoslavia).

Experimental plan and preparation of samples. The dehulling was performed on a laboratory pneumatic dehuller Hydromécaniques et Frottement (TECH MACHINE, Andrezieux-Boutheon, France).

The principles of the work during the experiment are shown in Figure 1.

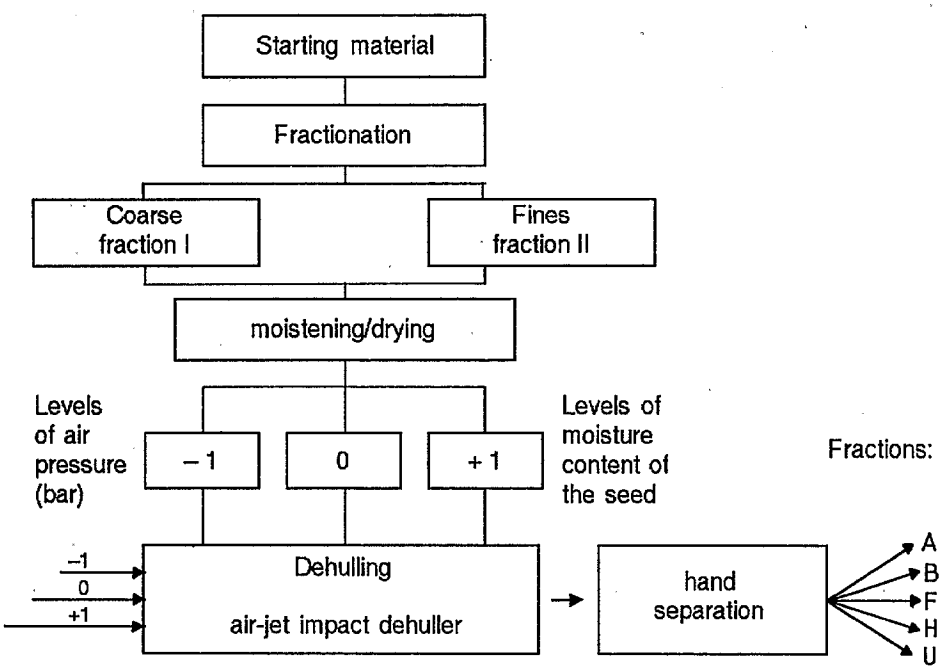


Figure 1. Preparation and dehulling of sunflowerseed

It is obvious from Fig. 1 that two factors were changed simultaneously during dehulling: the moisture content of the seed (M) and the air pressure (P) in the air-jet dehuller (factorial design 3^2, see Table 1).

Table 1. Experimental Conditions Selected for 3^2 Factorial Design[a]

Independent variables (factors)		levels +1	0	-1	Interval of variation
Moisture content (%)	M	5	8	11	3
Pressure (bar)	P	4	6	8	2

[a] Response functions (Y): Content of fractions (%)
Dehulling Efficiency: (U+F)
(Lusas criterion)

Control of dehulling. After dehulling the material was hand-separated into fractions, as proposed by Trachino et al. (1984). i.d.:

A - dehulled whole kernel
B - coarse particles, fraction > 3 mm
F - fines and dust, fraction <2 mm
H - hull
U - undehulled seed

The dehulling efficiency was evaluated on the basis of Lusas-criterion (1978). The sum of fractions (U+F) is considered as the criterion of optimum, and should be minimized in the function of moisture content of the seed and air-pressure in the dehuller.

Analytical methods used for the investigation of seed composition and methods for the determination of geometric and physical characteristics of the seed are given in the paper of Karlović et al. (1992).

RESULTS AND DISCUSSION

The chemical composition of separated fractions of hybrid seed KOLOS is given in Table 4, and the characteristics oin Table 5.

Table 4. Chemical composition of hybrid seeds

Characteristics	Fraction	
	I	II
Dry matter (%)	92.5	92.7
Oil content (% on DB)	41.1	40.3
Protein content (% on DB)	21.6	19.3

A series of experiments was performed for the optimizing of dehulling of sunflowerseed hybrid KOLOS. The response functions are shown in Figs. 2 and 3. The minimum of the response surface presents the optimum conditions for the dehulling of this sample.

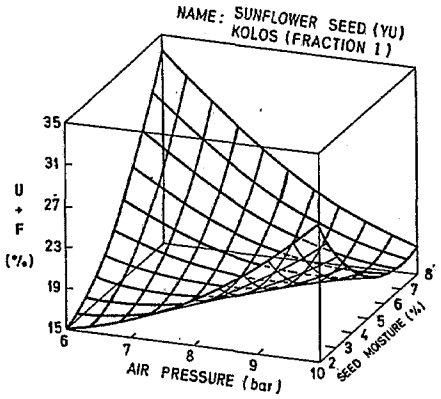
Table 5. Hull and kernel ratio and hull thickness

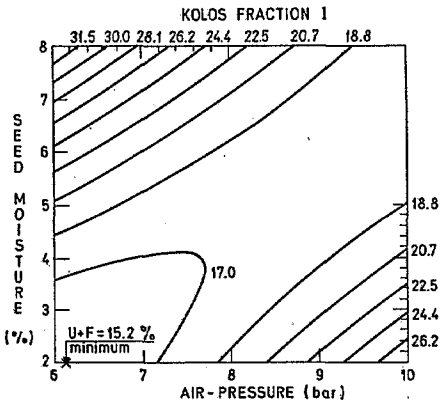
Characteristics	Fraction	
	I	II
Hull content (%)	29	27
Kernel content (%)	71	73
Hull thickness (mm) 10^{-2}	28	24

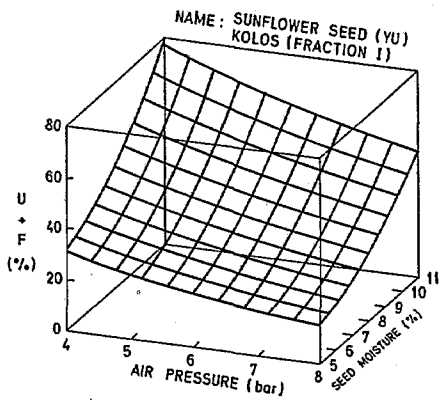
Geometric and physical characteristics of the seed. The results of the measuring of geometric and physical characteristics of sunflowerseed hybrid KOLOS are shown in Fig. 4 Table 6.

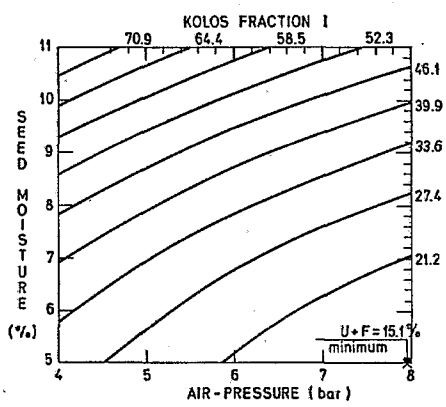
Table 6. Geometric and physical characteristics of sunflowerseed hybrid KOLOS

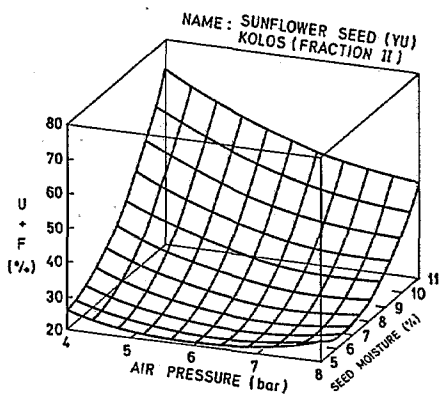
Parameter	Fraction	
	I	II
Seed mass $\bar{x}\pm 2s$ (mg)	114±57	71±33
Seed volume (mm^3)	381	201
Shape factor (L/l)	1.98	2.28
Specific mass (g/cm^3)	0.62	0.70
Mass of 1000 grains (g)	100.6	68.7
Liter mass (kg/dm^3)	0.36	0.40











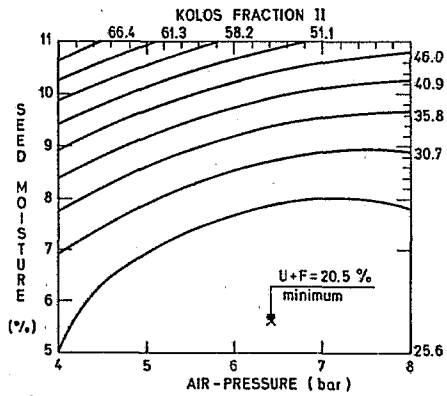


Fig. 2. 3D plot of the dependence of sum U+F on air pressure and moisture content of seeds

Fig. 3. Contour lines obtained from 3D plot in Fig. 2.

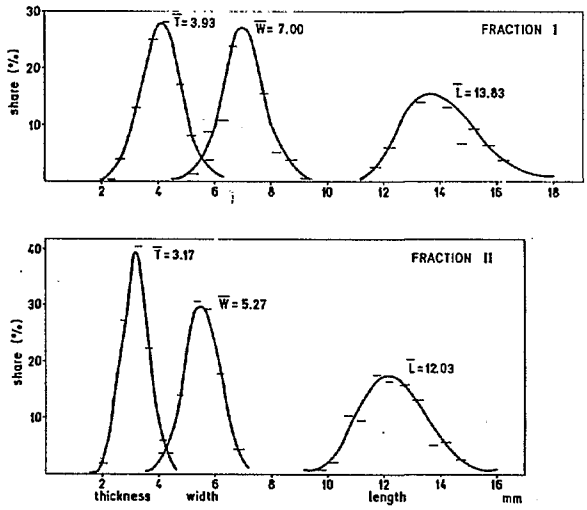


Fig. 4. Distribution of linear dimensions of KOLOS hybrid

CONCLUSIONS

The optimum conditions for the dehulling of sunflowerseed hybrid KOLOS, in the process of production of protein flour, are:

1. for fraction I (U + F = 15.1%) - M = 5.0%; P = 8.0 bar;
2. for fraction II (U + F = 20.5%) - M = 5.5%; P = 6.4 bar.

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