DEHULLING EFFICIENCY OF SUNFLOWER HYBRIDS GRICKO, OLIVKO AND NS-H-45 WITH THE LABORATORY „AIR-JET" IMPACT DEHULLER

Karlović, Dj., Dimić, E., Turkulov, J.
Faculty of Technology, 21000 Novi Sad
Škorić D.
Faculty of Agriculture, 21000 Novi Sad
Institute of Field and Vegetable Crops, Yugoslavia

ABSTRACT

The paper presents the efficiency of dehulling of sunflowerseed: one confectionery type (GRICKO) and two high-oil hybrids (OLIVKO and NS-H-45). The fatty acid composition of two high-oil hybrids is very different. Hybrid OLIVKO contains oil with high content of oleic acid (80%), while the oil of NS-H-45 is characterized by high content of linoleic acid (70%). The hybrid NS-H-45 is most widely spread in the production in Yugoslavia. A new method is suggested in this paper for the testing of technological characteristics of sunflowerseed on a laboratory air-jet impact dehuller.

INTRODUCTION

There are no real criteria for the evaluation of technological characteristics of some sunflower hybrids. Concerning the differences between certain hybrids, the data are mostly obtained by chemical analysis and determining of dehulling character of seed (Briffaud et al., 1986).

Having in mind the importance of dehulling in the processing of sunflowerseed and the fact that a lot of hybrids are hard to dehull (Turkulov et al., 1988), a need arose for the development of an objective method for the evaluation of sunflowerseed. Mollinard and Ribaillier (1983) described a laboratory air-jet impact dehuller. Using this aparatus and applying the method given in this paper, some important data for three Yugoslav sunflowerseed hybrids were obtained.

MATERIALS AND METHODS

Materials: Three sunflowerseed hybrids (GRICKO, OLIVKO and NS-H-45) grown on experimental fields of the Institute for agriculture in Novi Sad, were used for the experiments.

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.

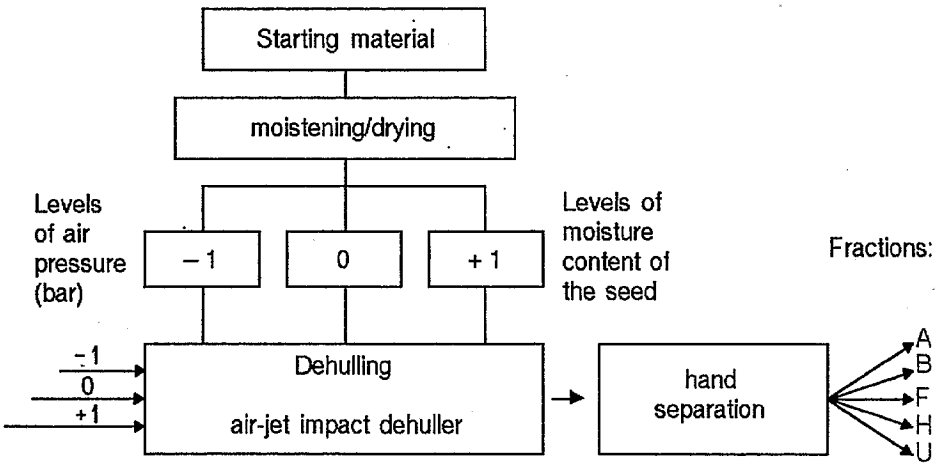


Figure 1. Preparation and dehulling of sunflowerseed

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 chemical composition of seed and oil. The methods used for the determination of seed composition are pres-ented in Table 2.

Table 2. Analytical methods for the investigation of seed composition

Characteristic	Principle	Method
Moisture content	gravimetric	ISO 665-1977
Oil content	according to Soxhlet	ISO 659-1988
Protein content (Nx6.25)	according to Kjeldahl	ISO 1871-1975

Methods for the investigation of geometric and physical characteristics of the seed. The methods used for the defining of geometric and physical characteristics of sunflowerseed are presented in table 3.

Table 3. Methods for defining of geometric and physical characteristics of sunflowerseed

Characteristics	Principle/method
Seed mass (mg)	weighing of 500 seeds (grains)
Seed dimensions (mm) (L-length, l-width, t-thickness)	hand measuring of 500 grains
Seed „Volume" (mm^3)	arithmetically V = L x l x t
Specific mass (g/cm^3)	immersion in 60% alcohol
Mass of 1000 grains (g)	gravimetrically
Liter mass (kg/l)	gravimetrically
Hull content (%)	hand dehulling - 50 g of seeds
Hull thickness (%)	hand measuring - 50 g of seeds

Statistical treatment of the results. The results of the measurements according to the factorial design were subjected to the RSM-2 program developed by Walker and Parkhurst (1984), while the drawing of the response surfaces was carried out with the aid of commercial program Statgraphics v.2.1. (1986/87).

RESULTS AND DISCUSSION

Table 4. Chemical composition of hybrid seeds

Characteristics	Hybrid		
	GRICKO	OLIVKO	NS-H-45
Dry matter (%)	92.1	92.9	92.3
Oil content (% on DB)	35.3	39.1	39.3
Protein content (% on DB)	19.4	21.8	23.3

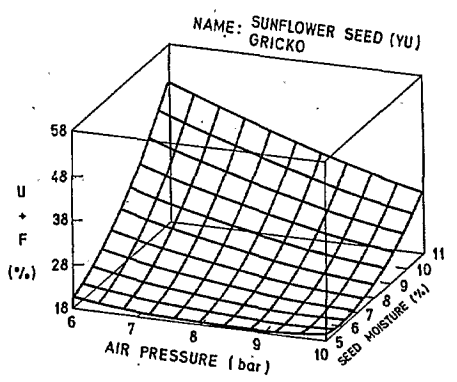
Table 5. Hull and kernel ratio and hull thickness

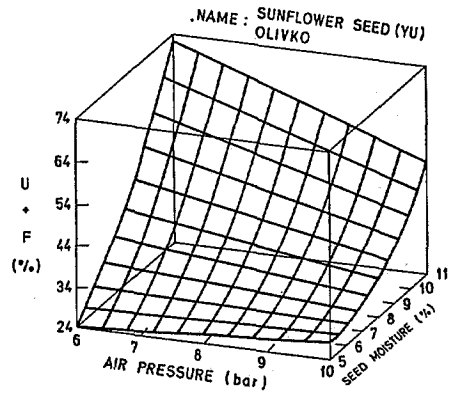
Characteristics	Hybrid		
	GRICKO	OLIVKO	NS-H-45
Hull content (%)	36	27	25
Kernel content (%)	64	73	75
Hull thickness (mm)	0.32	0.22	0.25

Table 6. Geometric and physical characteristics of sunflowerseed hybrids

Parameter	Hybrid		
	GRICKO	OLIVKO	NS-H-45
Seed mass $\bar{x}\pm 2s$ (mg)	77±31	63±24	57±15
Seed volume (mm^3)	201	211	248
Shape factor (L/l)	2.10	2.09	1.78
Specific mass (g/cm^3)	0.71	0.59	0.61
Mass of 1000 grains (g)	77.2	53.2	60.0
Liter mass (kg/dm^3)	0.39	0.34	0.35

A series of experiments was performed for the optimizing of dehulling of sunflowerseed hybrids GRICKO, OLIVKO and NS-H-45. The response functions are shown in Figs. 2 and 3. The minimum of the response surface presents the optimum conditions for the dehulling of these samples.





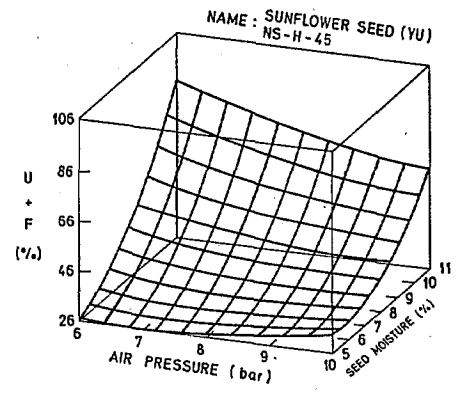
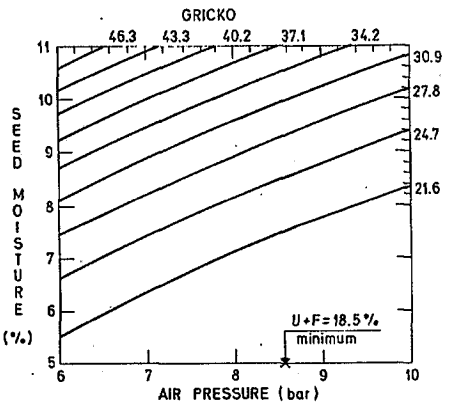
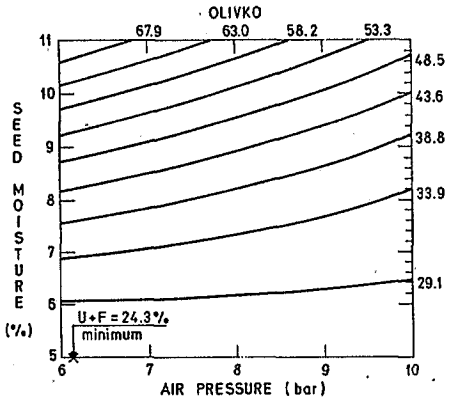


Fig. 2. 3D plot of the dependence of sum U+F on air pressure and moisture content of seeds





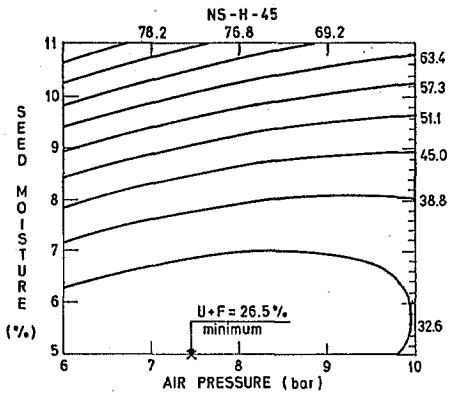


Fig. 3. Contour lines obtained from 3D plot in Fig. 2.

CONCLUSION

The obtained results point to a significant difference between the investigated hybrids. The best results during dehulling were obtained with the hybrid GRICKO - a confectionery type, followed by the oleic type OLIVKO, while hybrid NS-H-45 (with high linoleic acid content) is at the end.

The optimum dehulling conditions on the laboratory air-jet impact dehuller are:

Parameter	Hybrid		
	GRICKO	OLIVKO	NS-H-45
Moisture content of the seed (%)	5.0	5.0	5.0
Air pressure (bar)	8.6	6.2	7.4
Lusas criterion (U+F) (%)	18.5	24.3	26.5

REFERENCES

Briffaud, J., Melcion, J.P., Lorand, G., Maizieres, Y., Rev. Francaise des Corps Gras, 33: 11-17 (1986)

Lusas, E.W. Final Report on Development of Technologies for the Production of Low Fiber Sunflowerseed Meal and Food grade Flour, College Station, Texas A&M University (1978)

Molinard, M., Ribailler, D., Information Techniques CETIOM no 84, 3/1983 p. 19-24

Statgraphics STSC, Inc. Software Publishing Group, 2115 East Jefferson Street Rockville, Maryland 20852, 1986/87

Tranchino, L., Melle, F., Sodini, G., J. Am. Oil Chem. Soc. 61: 1261-1265 (1984)

Turkulov, J., Dimić, E., Karlović, Dj., Stefanović, S., Uljarstvo (Yugoslav Journal of Edible Oil Industry) 25: 93-97 (1988)

Walker, C.E. and A.M. Parkhurst, Cereal Foods World. 29:662 (1984)