THE EFFECT OF VARIETY AND HYDROTHERMAL TREATMENT OF WHOLE RAPESEED ON THEIR ULTRASTRUCTURE AND SELECTED PHYSICAL FACTORS

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There are available more and more works on the influence of hydrothermal treatment of rapeseeds on myrosinase activity /Kozłowska et al./1983/, Kozłowska et al./1984/, Maheshwari et al./1981/. The changes of seeds microstructure during inactivation - with special allowance for proteins and fat /Fornal et al./1986/, Yiu et al. /1983/, both for traditional and inproved seeds and also fat extractivity /Rudzka /1985/ are published. However there is no available information on basic physical features of traditional and improved seeds which can be essential from the point of view of their usability in storage and processing. Neither the works are published concerning possible changes of these features during hydrothermal treatment.

The present work was aimed at estabilishing the influence of hydrothermal treatment of whole rapeseed on:

- selected physical properties of seeds of various improvment degree
- relation between physical properties and the seed microstructure observed in the scanning electron microscope.

MATERIALS AND METHODS

Samples of following rapeseed varieties ware investiated:

- the Skrzeszowicki traditional variety
- the Beryl variety of zero erucic acid content
- the BOH double improved variety

Seeds were steamed in an experimental rotary steamer at steam pressure 0,2 atm for 20 min. Samples were collected and analysed after 3, 6, 9, 12, 15 and 20 min. Bulk density, fractional composition, the 1000 seeds mass, static friction coefficient, and the angle of slide were determined on the material dried in the air to identical moisture. Each feature was determined in eleven repetitions.

Microscopic preparations were analysed in the scanning electron microscope Tesla BS-300 at accelerating voltage 19 kV.

DISCUSSION OF RESULTS

In the applied method of whole seeds steaming a complete myrosinase inactivation was obtained after 6 min for all varieties used.

While investigating mass and heat exchange in this process there was observed a considerable water absorption diversification depending on the rapeseed variety /fig.1/. It is interesting that the seeds of the traditional Skrzeszowicki variety were moistened to 14,0% already after 3 min, and to 15,8% after 6 min, and next moisture remained stable throughout further steaming. The Beryl and BOH varieties seeds behaved differently.

Results of microscopic investigations of seeds hull let assume that the reason of various reactions of rapeseed during steaming process are the differences in the microstructure of this morphological part of seed /phot. 1/. Though seed hull of the Skrzeszowicki variety was the thickest i.e. 100 μm, and almost twice as thick as that of the remaining varieties, the loose arrangement of palisade layer may explain quick water penetration to the inside. The BOH double improved variety seeds, which were moistened the slowest in thase conditions, in spite of the same seed hull thickness as of the Beryl, had a considerably thicker layer of palisade cells and enlarged aleuron cell walls /phot. 1/. Differences in mass and heat exchange for rapeseed varieties were confirmed by the microphotographies of cotyledone cells. In the traditional rapeseeds /phot.2/ first signs of protein structure denaturation appeared already after 3 min of steaming, whereas in the case of the improved ones - after 6 min. Denaturated protein mass was found to accumulate inside the cells and fat - in the outer parts, what was observed also in the works of other authors /Maheshwari /1981/, Yiu et al./1983/. This could make fat obtaining easier.

Microscopic picture of rapeseed cotyledons cells steamed for 9 min was alike for all varieties and did not change essentialy in the further course of steaming /phot.2 and phot.3/.

It can be stated with a great dose of probability that above discussed changes are the reason of decrease of the next analysed factor, i.e. of bulk density /fig.1/. Obtained results show that the Skrzeszowicki variety seeds have the lowest bulk density 658,6 kg/m^3 in view 691,6 and 690,4 kg/m^3 for the Beryl and BOH varieties. Differences observed between the samples before steaming of these two varieties can be explained by the differences in their fractional composition /tab.1/ and in masses of 1000 seeds of parti - cular fractions.

Steaming of seeds resulted in decreasing of bulk density from 658,6 kg/m^3 to 610 kg/m^3 already after 3 min for the traditional rapeseed /fig.1/. Further action of steam did not seem to affect this value considerably. In the case of the improved varieties bulk density decrease after 6 min of hydrothermal treatment so after the time in which denaturation of protein and cotyledons cells took place. This caused the increase of the seeds volume and such state continued even after the seed had been dried /tab.1/.

It was also interesting to make a microscopic analysis of seed hulls of various varieties seeds in search of justifying differences in friction coefficient showed in table 2.

Such analysis /phot.4/ seem to comfirm the existence of differences in the character of seed hull surface only between traditional and improved seeds. The comparative element considered during the estimation of the crater-like surface was the width of the craters edges. The width was found to be greatest in the traditional seeds, which had a decisive influence on the size of the contact of the surface with the base. Also, hydrothermal process was observed to have caused further increase of crater edges width. This could influence the increase of friction coefficient and slide angle observed after steaming for each variety and each of the investigated surfaces.

CONCLUSIONS

1. Differences in physical features occur most vividly between the seeds of the traditional and improved varieties

2. Thickness and structural composition of seed hull have essential influence on differences in mass and heat exchange

3. Hydrothermal treatment considerably affects investigated physical properties; this is caused by the changes of seed microstructure

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FIG.1 MOISTURE (—) AND BULK DENSITY (---) CHANGES DURING STEAMING

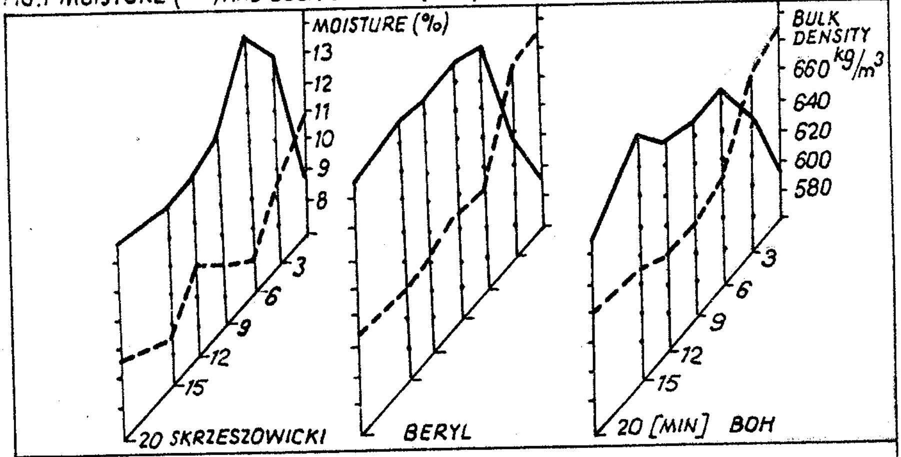

TABLE 1 CHNGES OF FRACTIONAL COMPOSITION DURING STEAMING

VARIETY \ DIAMETER mm		<1.4	1.4	1.6	1.8	2.0	2.2	2.5
SKRZESZOWICKI	O	0.57	2.66	19.20	38.95	29.27	9.62	2.50
	P	0.83	1.77	13.45	34.34	36.69	12.80	0.21
BERYL	O	0.58	3.23	18.08	36.03	33.28	9.05	–
	P	0.62	2.57	13.42	28.12	36.70	18.55	0.17
BOH	O	1.91	6.29	28.88	38.94	20.42	3.62	0.13
	P	2.61	5.12	22.64	34.48	27.17	7.95	0.04

TABLE 2. CHNGES OF FRICTION FACTOR AND SLIDE ANGLE DURING STEAMING OF WHOLE RAPESEEDS O - CONTROL
P - STEAMED

VARIETY \ MATERIAL		STEEL	RUBBER	WOOD	SLIDE ANGLE (°)
SKRZESZOWICKI	O	0.28	0.33	0.33	31.3
	P	0.33	0.35	0.37	33.1
BERYL	O	0.22	0.23	0.26	28.7
	P	0.29	0.28	0.30	29.4
BOH	O	0.23	0.24	0.25	27.6
	P	0.30	0.32	0.35	29.6

PHOT. 1 CROSS SECTION OF RAPESEED HULL

PHOT. 2 CROSS SECTION OF THE COTYLEDONES OF SKRZESZOWICKI

PHOT. 3 CROSS SECTION OF THE COTYLEDONES OF BERYL

PHOT. 4 SURFACE OF THE RAPESEED HULL