Physical properties of soaps obtained with the participation of plum kernel oil (*Prunus domestica* L.)

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GOAL OF THE STUDY

In the present study, plum kernel oil (*Prunus domestica* L.) is used as an alternative raw material for soap production. The aim is to study the effect of oil on the physical properties and quality of soap.

METHODOLOGY OF THE INVESTIGATION

Six variants of soap (№1-6) with plum kernel oil (PKO), palm oil (PO) and coconut oil (CO) in different proportions were prepared.

Sensory characteristics - Consumer tests with soaps have been performed. Probants evaluate the indicators - surface type, color, resistance to erosion, foaming, hardness and general perception after the use of soap bars.

Surface tension - The maximum pressure P max were determined that must be applied to blow the air bubble from the end of the capillary. In this method, the air bubble moves at a constant speed through the capillary which is immersed in the test solution. The pressure is created with the help of a water manometer.

Hardness and stickiness of the Texture Analyzer device - To investigate the texture parameters, a penetration experiment was performed by cylinder (Ø = 5 mm, speed of the deformation was 1 mm/s and maximum deformation was 5 mm).

MAIN RESULTS FROM THE STUDY

Overall perception is an important indicator influencing consumer choice. It is determined by the feeling on the skin after washing with soaps. Consumers are effected by whether their skin is soft, moist, dry, taut, etc. The conclusion of the sensory analysis shows that the evaluators give the highest score for the overall perception of the sample №3. This can be seen from Fig. 1.
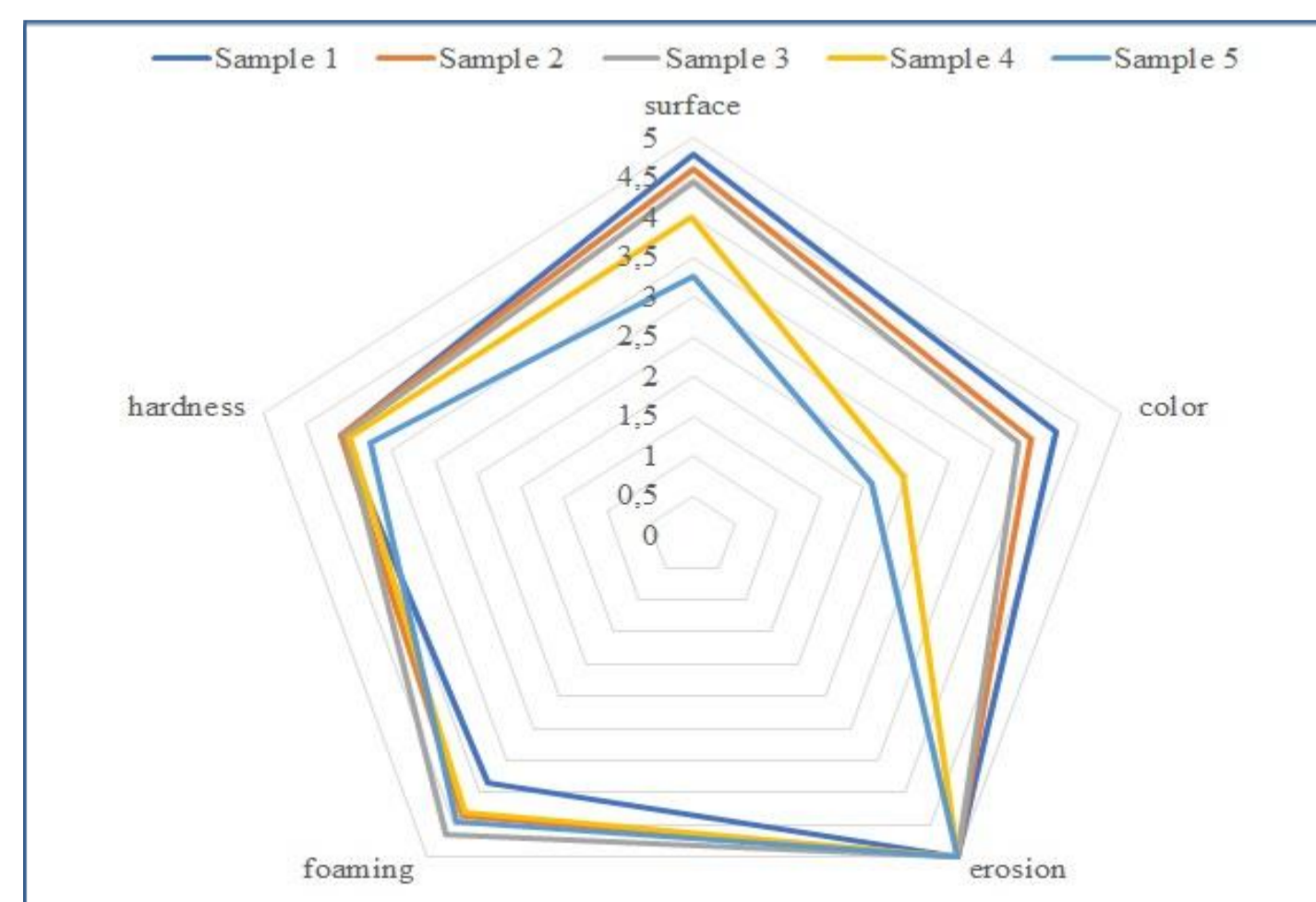

Fig. 1. Sensory analysis

The lowest surface tension is observed in solution 5, which indicates that it will be the most stable in its study over time. As the surface tension increases, the stability of the solutions decreases.

The indicators hardness, modulus of deformation, deformation work, adhesion force and stickiness characterize the surface, the resistance to deformation during use and the consistency of soaps. The hardest sample is sN_1, which does not contain plum kernel oil. As the plum oil content increases, the hardness of the soaps decreases. The results for the deformation and stickiness of the samples are similar. This proves that the amount of plum kernel oil in the soap recipe is somewhat limited. The corresponding results are given in Table 1. Soap samples from №1 to №6 correspond to markings sN_1 to sN_6 in Table 1. and the diagrams in Fig. 2(a-f).

Table 1. Oil mixtures used for soap variants

| Soap sample	Hardness[1] (N)	Modulus of deformation [2] (N/mm)	Deformation work [3] (N.mm)	Adhesion force[4] (N)	Stickiness[5] (N.mm)	Hardness2[6] (N)
	avg±std	avg±std	avg±std	avg±std	avg±std	avg±std
sN_1	134.187±1.908d	132.153±15.482d	70.756±4.717de	-4.167±0.610bc	-5.228±0.117c	Is not available
sN_2	130.698±7.856d	88.065±7.681c	81.865±9.400e	-2.085±0.288a	-2.295±0.159a	Is not available
sN_3	103.880±2.028c	91.806±3.762c	63.191±4.305d	-2.233±0.148a	-3.915±0.445b	Is not available
sN_4	57.811±2.243b	49.767±6.204b	27.044±1.726c	-8.517±0.673c	-5.301±0.598c	97.225± 2.404a
sN_5	49.789±5.738b	54.069±6.681b	21.915±2.326b	-3.301±0.369b	-5.303±0.204c	93.042± 1.149a
sN_6	37.127±4.784a	23.536±3.350a	18.483±2.821b	-2.619±0.396a	-5.730±0.342c	155.034±18.315b
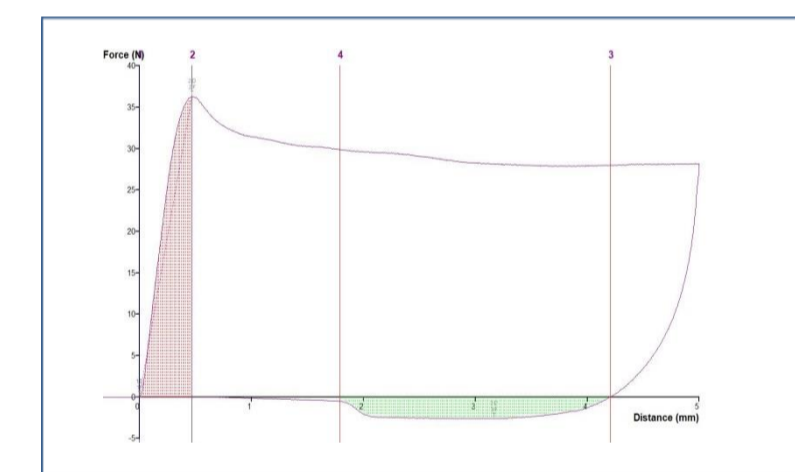
Fig. 2a. Hardness diagram of soap samples sN_1.The hardest soap a plastic-elastic body with medium but relatively low stickiness.
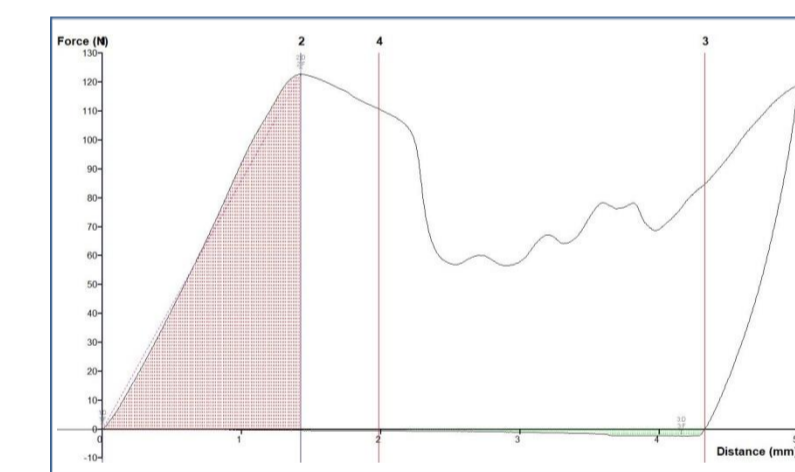

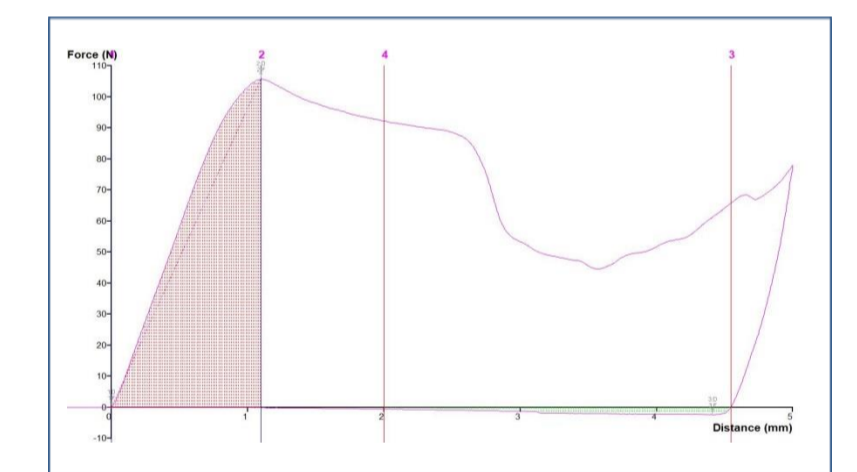**Fig. 2b.** Hardness diagram of soap samples sN_2.Very hard soap deformable, with the lowest stickiness.

Fig. 2c. Hardness diagram of soap samples sN_3. Hard soap, deformable, stickiness is small but larger than sN_2.
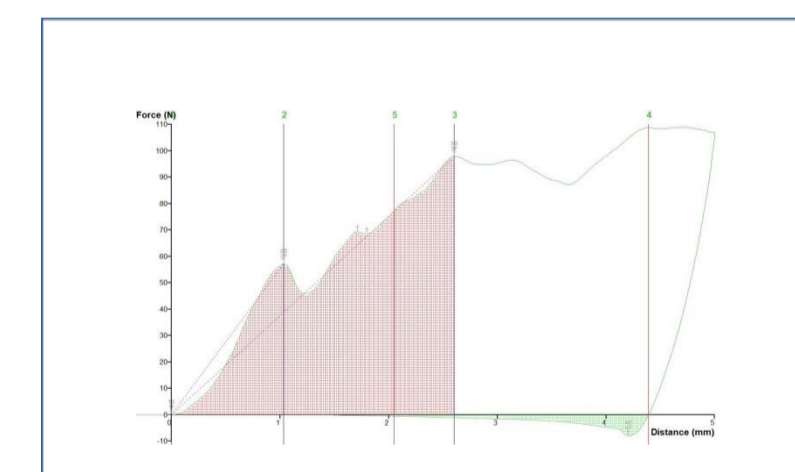

Fig. 2d. Hardness diagram of soap samples sN_4. Elasto-plastic, hard soap, highly deformable, with high adhesive strength and medium stickiness.
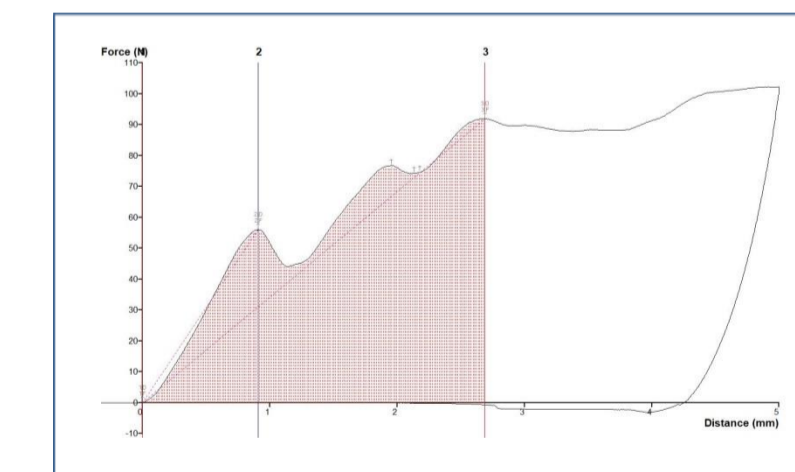

Fig. 2e. Hardness diagram of soap samples sN_5. Elasto-plastic, hard soap, highly deformable, with low adhesive strength and medium stickiness.
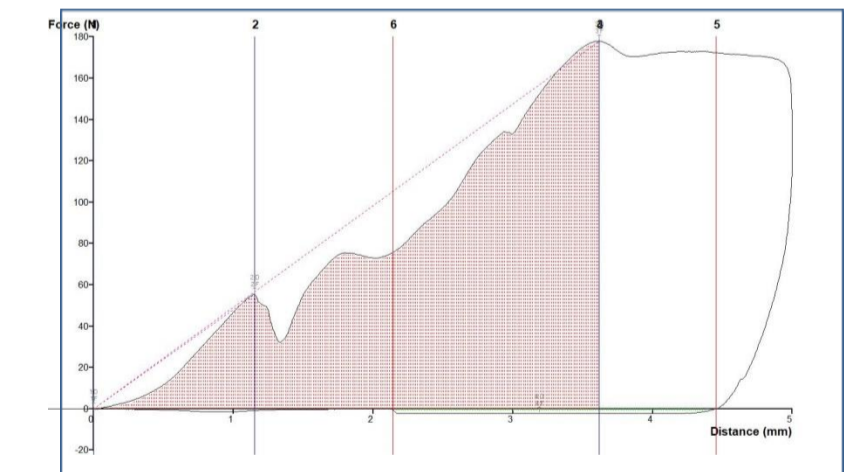

Fig. 2f. Hardness diagram of soap samples sN_6. Elasto-plastic, hard soap, very deformable, with low adhesive strength and medium stickiness.

CONCLUSIONS

From the conducted research of the prepared soaps it can be concluded that the samples containing up to 20-30 % plum kernel oil have the highest evaluation by the users in terms of sensory characteristics - general perception and foaming, and have acceptable values of physical indicators - hardness, deformation during use, stickiness and surface tension of soap solutions. Plum kernel oil has the potential to be used in the production of soaps by the cold method.