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The research on the extraction of fatty substances from non-textile residues of the cocoon milling production

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Abstract
A pupa oil from non-textile waste of cocoons of silkworm was obtained by using the method of hot extraction. The organic solvents ethanol, hexane, petroleum ether and chloroform were used as extractants.
The outcome of the resulting oil is defined depending on the extraction progress. It was found out that the highest outcome of pupal oil from wastes of cocoon winding production was obtained with an extractant of ethanol with a 240 minutes duration of extraction.
A physical and chemical analysis of the oils obtained was carried out using various extractants.

Keywords: petroleum ether, ethanol, hexane, chloroform, fatty substances, phosphatides, sterols, pigments, cocoons, silk-smoothness

Introduction

Various by-products are obtained In the process of producing raw silk. Of these, the main ones are the unwinded parts of the cocoon - the otone, the putank, the undone and the pupa. With the exception of pupae, the majority of the rest is used for further processing.
Some research work is devoted to the problem of the use of fibrous waste. The authors of the work [1-2] proposed using the fibrous waste to produce special types of paper, surgical sutures.
A significant proportion of the total weight of waste of cocoon winding along with fibrous silk waste is the pupa. The weight of the dry pupa is 51-53% of the cocoon mass and, unlike the mass of the cocoon shell, is variable. So, for a live pupa, it reaches 1.0-2.0 g, decreases 3-4 times during drying. It contains up to 25-27% of fatty substances, a significant amount of proteins, as well as zoopolyurea and mineral impurities [3].
Fat substances from pupae of silkworm can be extracted by pressing or extraction with an organic solvent. The extraction method results in more oil: a distinction is made between cold and hot extraction. The first is carried out at room temperature for 24 hours; the second is at the boiling point of the extracting solvent.
A hot extraction method was chosen, as extractants, ethanol, hexane, petroleum ether and chloroform were used. The extraction time varied from 60 to 360 minutes. The results of the studies are given in Table 1.

Table 1: Effect of the extract duration on the outcome of fatty and waxy substances

No	Duration of extract-min	Number of allocated fatty substances,%			
		ethanol	petroleum ether	hexane	chloroform
1	60	14,25	14,70	15,20	15,86
2.	130	19,10	19,50	19,36	19,57
3.	180	24,34	19,00	19,73	20,10
4.	240	26,26	18,50	20,03	20,42
5.	360	26,05	18,20	20,50	20,74
6.	1440 (room. ^{0}C)	9,20	18,80	18,90	19,04

According to the data obtained, it can be seen that the highest outcome is occurred when ethanol is used as the extractant with 240 minutes extraction time.
Having been obtained in this way, fatty substances are a thick, viscous oily liquid with an unpleasant odor. To fully describe the properties and the possibility of using fats and oils, it is necessary to know its composition and be able to distinguish their structural elements. However, the complexity of the composition leads to the impossibility of defining them using any of the modern research analytical methods but requires a combination of several based on various physical and chemical principles.
Fats (fatty substances) and oils are characterized by specific constants or numbers which express the quantitative content of certain constituents or chemically homogeneous structural units: the free fatty acid content is characterized by the acid

number, the total amount of both free and bound fatty acids is characterized by the saponification number, the content of triglycerides is characterized by an etheric number. The total degree of fat, it is characterized by iodine number.

Physical and chemical properties of fatty substances are presented in Table 2.

Table 2: Physical and chemical parameters of "pupal" oil

Index	"Pupal" oil allocated			
	ether	**chloroform**	**hexane**	**ethanol**
Density, kg / m^3	923,0	926,0	924,0	932,0
Softening temperature, oK	303-305	304-306	304-306	307-309
Unsaponifiable residue,%	3,8	3,9	3,9	4,9
Acid number, mg KOH / on g	72,4	72,4	72,5	82,7
Saponification number, mg KOH / g	174,2	174,6	174,8	175,4
Iodine number, g I2 per 100 g	124,7	124,4	124,8	124,9
The ether number	101,8	102,1	102,3	92,7
Ash content,%	0,122	0,128	0,130	0,162

Fats and oils consist not only of glycerides. They always contain a variety of related substances. The quantity of them is constant and depends on the nature and quality of the initial oil-bearing raw material and the conditions for the extraction of oils from them. Even obtained from the same raw materials in different ways, the oils differ significantly from one another in terms of chemical and physical properties, which is due to the different contents of the co-products.

Thus for obtaining a clear idea of the nature of fatty substances extracted from pupae of the silkworm by extraction with various solvents it is not enough to know only the composition of glycerides, but it is also necessary to study the collateral substances to which free carboxylic acids, phosphatides, sterols, pigments, proteins and other substances extracted from the exoskeleton are referred.

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