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NEW EMULSIFIER BASED ON WASTE OIL FROM FRYING FISH FOR LUBRICATING FUR

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Abstract
This article explores the extraction and characterization of an emulsifier derived from waste oil generated during the process of frying fish, with a specific focus on its application for greasing Karakol fur. The emulsifier's chemical composition was analyzed through IR-spectroscopic analysis, and its main physical properties were thoroughly investigated. The findings revealed the presence of lubricants, esters, antibiotics, homogenous substances, and sulpho groups within the emulsifier. Moreover, the study demonstrates the economic and ecological efficacy of the newly developed emulsifier. This innovative approach not only addresses the utilization of waste oil but also presents a sustainable solution for greasing applications, emphasizing its potential as an environmentally friendly alternative.
Keywords: black fur, lubricants, emulsion lubrication, emulsifier, homogenous substance, waste oils.

Introduction

The development of natural fur extraction technology that can meet both quality and environmental requirements at the world level is one of the urgent issues. Taking into account the increasing demand and prices for natural products, it is necessary to review the existing technological processes, to search for chemical materials of low value to use them rationally and to localize them.

Materials and methods

The range, appearance and operational properties of natural furs depend significantly on the lubrication process and the nature of the lubricants. The emulsion method is mainly used to lubricate the fur. This method allows for a thin and even distribution of lubricants, giving the fur product softness, shine and flexibility. However, the emulsion method of lubrication requires the use of several different chemicals. When creating an emulsion, a lubricating composition consisting of natural and synthetic oils is selected, and surfactants and other substances are used. Surfactants, especially nonionic ones, are toxic and harm the environment and the human body.

Although many scientists are conducting research aimed at improving the lubrication process, they have not been sufficiently approached to obtain modern lubricating materials that meet ecological requirements. This requires extensive research in this direction.

When composing the composition of lubricants, it is necessary to take into account their chemical interaction with skin tissue fibres, dyes and additives, mainly hydrated chromium oxides. They mainly react with emulsifiers. When using other additives, for example, aluminium or vanadium, emulsifier reactions should be considered. The surface charge of the

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new inorganic materials varies with the chromium charge, which affects the tendency of different emulsions to stick. This chemical composition can be adjusted by changing the Rn, but also by imposing a different requirement on the length of the fatty chains.
Almost any oil can be used as a neutral part of the lubricant. Triglycerides are the most common, but wool oil and mineral oils are also used. Oils are selected in such a way that they should not be volatile (to maintain stability), dissolve in a minimum amount of water and be liquid at a temperature of 40°C. It is advisable to choose oils with a slightly longer carbon chain. This ensures that the oils are located between the fibres and not within the fibres. Usually, oils of different composition are used. Aesthetic properties - it should be resistant to discoloration, and hardening and should not have an unpleasant smell. An important chemical property of oil is that it can be easily sulfonated, sulfated, or oxidized, particularly as a starting material for its emulsifier.
Such studies include the use of additive-free microemulsions by the addition of aliphatic alcohols and sulfated per-esterified phosphatides of rapeseed oil. The stability of these systems is somewhat reliable. A self-emulsifying lubricating solution can be obtained by sulfonating the oil obtained from wood (tall oil). Polymerizable oils were also used in lubrication. To finish napalm skin and fur, to reduce the viscosity of thermoplastic binders and to give softness and pleasantness, aqueous emulsions of natural and synthetic waxes were used.
Nonionic emulsifiers ensure the stability of waxy emulsions. As the best stabilizing agent, nonylphenol ethoxylate with 9 mol of ethylene oxide was obtained, but after its ecotoxicity was found in the production of industrial products, its use was prohibited, it had only 30% biodegradability. Alternatively, ethoxylated fatty acids are obtained, making it 100% biodegradable.
Based on the above, it should be noted that the development of new lubricants is one of the priority tasks in the leather and fur industry. In the laboratories of many countries, research is being carried out to give the necessary softness to leather and fur, to eliminate oiliness, smell, and price-related defects in the finished product, and to achieve a quality finished product. In particular, finding new sources of oils and fats of constant quality, cheap, light-resistant, as colourless, odourless as possible, well attached to collagen fibres, able to become emulsifiers, and not harmful to the environment, created the need to carry out research in a new direction.
Treatment of fur skins - in the greasing process, animal oils, vegetable and mineral oils, marine animal and fish oils, products of oil and oil processing, and lubricating pastes obtained based on the above-mentioned oils and fats are used. In production enterprises, usually, no lubricants are used, but their mixtures, that is, a composition of different lubricants. In this case, not the lubricating materials themselves, but their aqueous emulsions are used to lubricate the fur.

Results and discussion

In the research work, fish was fried several times in sunflower oil, the content of unfit used oil was determined, and after bleaching and cleaning, it was used in the process of emulsion greasing of carp skins.
When lubricating, lubricants should not contaminate the hair coat and be easily removed during subsequent finishing processes. Lubricant emulsions have these properties consist of small oil particles and are in equilibrium with water. Continuing this work, an emulsifier was obtained from used oil.

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After studying the fatty acid composition of waste oil, the amount of fatty acids and alkali was taken in mole ratio, and the sodium salt of fatty acids was formed through the following general reaction mechanism:

$$R - COOH + NaOH = R - COONa + H_2O \qquad (1)$$

A thermally stable vessel was selected for the waste oil and alkali obtained in a mole ratio under laboratory conditions and a magnetic stirrer was used. First, the waste oil was heated to a temperature of -60 ℃, and then a 40% alkali solution was slowly poured into it. The process was continued until a homogeneous, thick substance was formed. The duration of the procedure was 1-1.5 hours. The resulting emulsifier is light yellow in appearance, odourless, hardens at 25-28 ℃ and turns dark at 30-40 ℃. Emulsifier production does not generate waste and does not require complex chemical processes and conditions.

IR-spectroscopic analysis was carried out to get a clear picture of the object under study.

The identification of IR spectra was analyzed according to the characteristics of the absorption frequencies of different groups of atoms [12].

Alkenes appear in medium intensity at the absorption frequency of 3010.88 cm^{-1} in the =SN valence vibration field. They are acyclic unsaturated hydrocarbons that form a homologous series, containing one double bond between carbon atoms.

2954.95, 2920.23 and 2850.79 cm^{-1} – alicyclic compounds are formed with strong intensity in the C–H valence vibration, which is usually found in petroleum, essential oils, stearin, steroids, antibiotics, etc.

At the absorption frequency of 1743.65 cm^{-1} of the IR spectra, aliphatic complex ether groups are formed in the C=O valence vibration, which is usually absorbed in the 1750 - 1735 cm^{-1} region.

The absorption frequency of 1558.48 cm^{-1} belongs to imine groups, and in the S=N valence vibration, imine organic compounds show strong intensity. Imines are oily or crystalline substances that are generally insoluble in water and soluble in organic solutions.

For salts, at absorption frequencies of 1462.04 cm^{-1} and 1423.47 cm^{-1}, it is possible to observe the formation of nitro compounds with very strong intensity in the valence vibration of N=O, and peaks corresponding to nitrone ethers in the areas of 1444.68 cm^{-1}.

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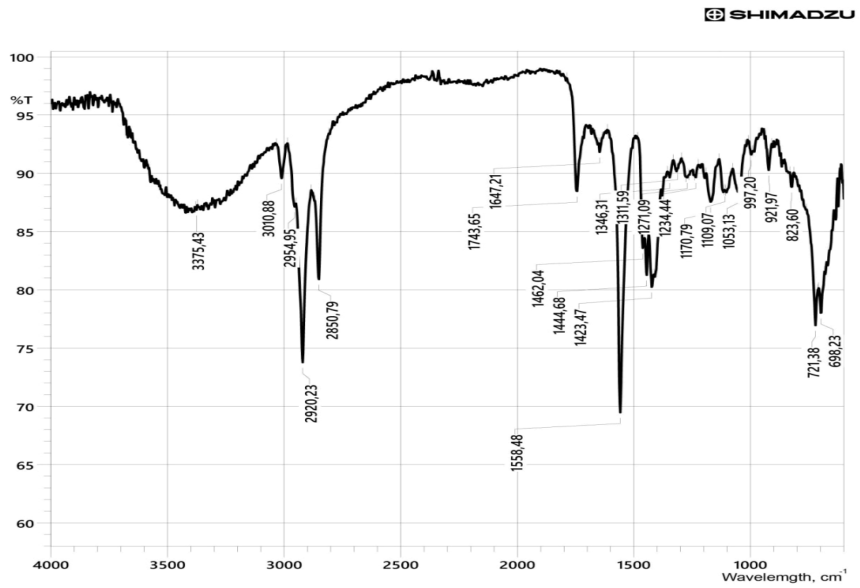

Fig. (1) IR-spectrogram of emulsifier obtained from waste oil

At the absorption frequencies of 721.38 and 698.23 cm^{-1}, sulfoxide and sulfone groups appeared in varying intensities in S-O valence vibration. The presence of sulfur groups can give the studied emulsifier high chemical and thermal stability and water solubility properties of organic solvents and some lower molecular representatives.

The results of the conducted research showed the possibility of obtaining emulsifiers for the emulsion lubrication process, in addition to obtaining economical and ecological lubricants based on local waste lubricants.

Conclusions

The results of IR-spectroscopic analysis are explained by the formation of compounds belonging to lubricants, ethers, antibiotics, homogenous substances and sulfur groups in the obtained emulsifier. In this case, the stability of the emulsion was taken into account, it was emphasized that it should not contain a sharp-smelling and toxic substance. The stability of the emulsion allows the black fur to be absorbed into the skin tissue and evenly distributed, and the lubricants are adsorbed by the collagen fibres. Fur retains its smell well, so the correct choice of lubricants is important for improving the aesthetic properties of fur. In addition, this active emulsifier binds cations and anions in water and precipitates. This prevents the formation of toxic substances in working solutions, specifically wastewater.

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