# Methods of Refining Technical Waste Fats

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## Introduction

Fats are row materials being closely associated with human beings from the beginning of their existence. According to the report of the UN Food and Agriculture Organization, the world production of fats reaches approximately 190 million Mg per year, wherein the largest share represent vegetable fats [1]. The management process of fat raw materials is inevitably associated with formation of fat waste deposits. It is estimated that annually in Poland about 30 thousand Mg of waste vegetable oils are being used for heating, production of animal feeds or end up in wastewaters [2]. Properly executed process of refining waste fats will enable their re-use as a fully valuable fat raw material.

## Experimental Part

Physical and chemical characteristics of waste fats applied in the research tests:

Used cooking oil: the acid number – 7.8 [mgKOH/g], the saponification number – 213 [mgKOH/g], the Iodine number – 87 [g]$_2$/100g], the iodine colour scale value – 100.

Waste animal fat classified as 3$^{rd}$ category: – the acid number – 45 [mgKOH/g], the saponification number – 193 [mgKOH/g], the Iodine number – 60 [g]$_2$/100g], the iodine colour scale value – <400.

## Research Methodology

*Deodorization with acids of waste animal fat and used cooking oil.* Fat was heated to the temperature of 65-70°C, and when stirring 0.5-1% m/m of concentrated sulfuric acid (into animal fat) and phosphoric acid (into used cooking oil) were added. The deodorization process was performed at a temperature of 90°C, stirring the reagents on the steam bath and bubbling nitrogen through for eight hours. An assessment of odour intensity was carried out.

*Deodorization with $ClO_2$ solution of waste animal fat and used cooking oil.* A sample of fat in an amount of 50g was heated to melting point and 10g of 200 ppm $ClO_2$ solution was added. The sample was stirred and heated for approx. 10 min., subsequently it was discontinued for 12 hours. The sample was heated again, the water was separated, and it washed two times with 10 ml of water. An assessment of odour was carried out.

*Research study on fat raw material decolourisation process.* Fat raw material was introduced into a flask with stirrer, then heated to a temperature of approx. 100°C, and stirred under a vacuum for 20 minutes. Next, the JELTAR 100 bleaching earth was added in a proportion of 1.5% in relation to the batch. The mixture was kept under a vacuum (approx. 10 mm Hg) for 30 minutes at a temperature of 100°C. The mixture was cooled to a temperature of 70°C and the bleaching earth was filtered off. Colour of the sample was determined according to the iodine colour scale.

## Discussion on Research Findings

Application of the JELTAR 100 bleaching earth gives the result of whitening the samples, both of waste animal fat and used cooking oil without affecting the improvement of odour intensity, see Table 1. Samples, where $ClO_2$ solution was used, simultaneous improvement of samples' colour and odour was derived.

**Table 1**

**The results of analytical determinations of fat materials after deodorization and decolourisation tests (The Odour Awareness Scale: A-extremely unbearable odour, B-unbearable odour, C- pestering odour, D- bearable odour, E- weak odour, F- very weak odour, G- no odour)**

| No. | Symbol of a sample and description of proceedings | Iodine colour scale value | Odour intensity value |
|---|---|---|---|
| 1. | Waste animal fat: | >400 | B |
| | - JELTAR 100 | 15 | C |
| | - $ClO_2$ solution | 35 | E |
| | - Deodorization of $H_2SO_4$ | <400 | F |
| 2. | Used cooking oil: | 100 | D |
| | - JELTAR 100 | 10 | D |
| | - $ClO_2$ solution | 30 | F |
| | - Deodorization of $H_3PO_4$ | 95 | F |

Deodorization of waste fat samples utilizing the classic method using acids improves the odour of the sample, however without any effect on colour improvement.

## Findings

The process of decolourization and deodorization of waste fats can be effectively performed in a single unit operation by using an aqueous solution of $ClO_2$.

## Literature

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2. Ferenc Z., Pikoń K.: Review of type and quantity of grease and oil waste in Poland. The Archives of Journal of Waste Management and Environmental Protection/. **Vol. 2**, 2005.

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