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REMOVAL OF SULPHUR COMPOUNDS FROM DIESEL FUEL

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High sulphur content in automotive fuel increases its corrosive aggressiveness and ability to fouling, which results in shorter engine life. Also getting into the atmosphere with exhaust gases, sulphur oxides lead to the formation of acid rain, which has a rather large negative impact on the environment. Therefore, at the moment it is relevant to search for effective and economically favourable ways of desulphurisation of diesel fuel, while maintaining its octane number.

Table 1

Main methods of diesel fuel purification from sulphur compounds

Cleaning method	Description	Shortcomings
Extraction [1]	Dissolution of sulphur-containing components in solvent (N,N demethylformamide, acetonitrile, methanol, etc.)	- Reduced yield of the final refined product; -Incomplete purification, resulting in the need to use additionally another method of sulphur removal.
Hydrotreating [5]	Interaction of hydrogen with diesel fuel in the presence of catalysts (aluminocobalt-molybdenum or aluminonickelmolybdenum). As a result, between hydrogen and sulphurous, nitrogenous, oxygen-containing compounds, hydrogen sulphide, ammonia and water.	- Bulky construction; - High burden on the ecosystem; - Use of expensive catalysts and hydrogen; - Deterioration of anti-wear properties of fuel; - Need to comply with harsh conditions (380-420°C-temperature, 4 MPa-pressure).
Sulphuric acid purification [4]	Mixing the fuel with a small amount of 90-93% sulphuric acid. B chemical reactions produce a purified fuel, and all the undesirable impurities are converted into a toxic, viscous mass called "sour tar".	- The need for large quantities reagents; - High cost; - Large size of the construction.

Absorption purification [3]	Selective dissolution of sulphur-containing components with heat input and heat dissolution under high pressure.	- High cost; -Complexity of equipment
Adsorption Purification [3]	Selective extraction of sulphur compounds by solid adsorbents (clays, bauxite, silica gels, active carbons, etc.)	- Partial recovery of adsorbents

Based on the data given in Table 1, it can be concluded that adsorption method is the most simple and economically favourable, at the same time at the same time provides the necessary degree of fuel purification.

There is currently a method of removing sulphur from cracking petrol or diesel fuel by adsorption, using as adsorbent a mixture of expanded perlite, clay, silicon and aluminium oxides with the addition of nitric acid. mixture of expanded perlite, clay, silicon and aluminium oxides with addition of nitric acid. This adsorbent is quite expensive, so our task is to produce the cheapest variant using fly ash fraction of 80-100 microns, which already contains the necessary compounds, while providing the required degree of purification from sulphur compounds and high wear resistance.

Figure 1 shows a schematic diagram of the adsorbent fabrication unit, which was placed in the fume hood to remove the emitted vapours.

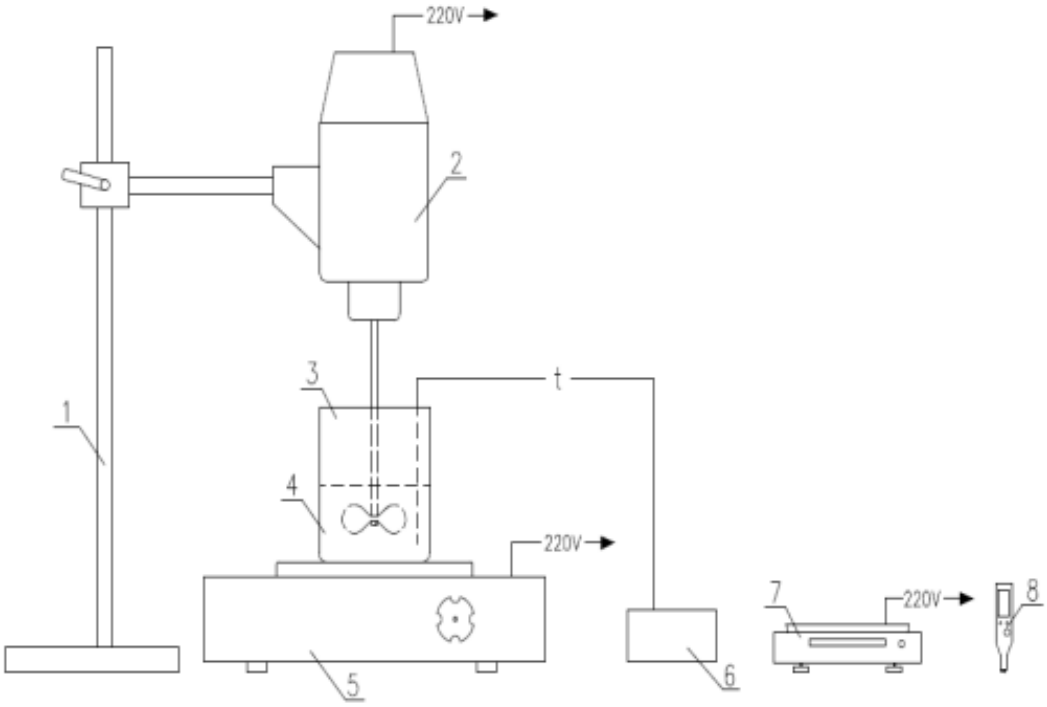

Figure 1. Scheme of the installation for adsorbent production:

1 - tripod with clamp; 2 - electromixer; 3 - metal container; 4 - suspension;
5 - electric cooker; 6 - temperature meter OVEN; 7 - electronic scales;
8 - hydrogen index meter (pH-meter)

The work on the plant for the production of adsorbent is carried out as follows - with the help of electronic scales 7 we prepare suspensions of the components necessary for the preparation of suspension, which are then ıplaced in a metal container 3. Then this container is installed on an electric plate 5, where the gel is cooked with constant stirring stirrer with an electric motor 2, fixed by a clamp on the tripod 1. Suspension temperature is controlled by a temperature meter - Aries 6. To measure the acidity of the gel, a hydrogen index meter (pH-meter) 8 is used. To determine the time, a stopwatch is used (not shown in Fig. 1).

Methodology of experimental preparation of adsorbent on the basis of 43% sodium hydroxide NaOH and fly ash includes the following steps.

1. We set the numerical value of aluminosilicate modulus and calculate the necessary proportions of 43% sodium hydroxide solution, fly ash, sodium carbonate and a certain amount of water.

2. Weigh the 43% sodium hydroxide solution, water and fly ash separately in the required quantities.

3. Slowly pour the fly ash into a metal container, add water and stir constantly water and stir constantly.

4. Switch on the electric cooker.

5. Add 43% sodium hydroxide solution, as a consequence of which the temperature rises spontaneously.

6. Ensure that the temperature does not exceed 90°C by stirring continuously with an electric stirrer at a certain speed for 50-60 minutes.

7. As the gel cools, add NaHCO3 (baking soda), the gel will swell.

8. The obtained expanded gel is subjected to heat treatment in a muffle furnace at a temperature of 300-500°C [6] to obtain a solid porous material - adsorbent.

The cost-effectiveness and simplicity of this method makes it possible to note that this type of purification is suitable both at the stage of production of diesel fuel and directly in the places of its application. It should be noted that at industrial implementation of the proposed method, it is necessary to select the process of regeneration of the spent adsorbent, allowing to return it to the production cycle, preserving its adsorption abilities. Otherwise, the cost of utilisation of constantly accumulating production waste will negatively affect the cost of the finished product.

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