Table 1. Low-temperature properties (adding LFDF)

Blend	CP, °C	CFPP, °C	PP, °C
DF + Ad	–6	–25	–36
DF + 3 % vol. LFDF + Ad	–6	–15	–36
DF + 5 % vol. LFDF + Ad	–6	–20	–35

Table 2. Low-temperature properties (adding HFDF)

Blend	CP, °C	CFPP, °C	PP, °C
DF + Ad	–6	–25	–36
DF + 3 % vol. LFDF + Ad	–6	–19	–35
DF + 5 % vol. LFDF + Ad	–6	–17	–42

Based on the results presented in Table 1 the addition of LFDF to the DF sample has a negative effect on low-temperature characteristics. CP and PP doesn't change, but CFPP increases. More clearly, the reduction in the effectiveness of the additive when adding 3 % vol. LFDF (CFPP increased by 10 °C).

From the results presented in Table 2, the addition of 3 % vol. HFDF has no effect on PP, with the addition of 5 % vol. HFDF reduces the PP by 7 °C. Adding HFDF does not affect the CP of the blends, but it worsens the CFPP.

The observed effects can be explained: an increase in the content of light paraffins in the fuel when adding LFDF postpones the formation of large bound crystal structures, but when a certain temperature is reached, their formation occurs instantly and the additive does not have time to work, structures are formed that plug the filter (the CFPP worsens).

Heavy paraffins begin to crystallize first, which allows the additive to work earlier, thereby effectively slowing down the growth of crystals and preventing solidification of the fuel (reduce PP). However, an increase in the content of heavy paraffins in the fuel negatively affects the CFPP, since their crystals are initially larger and plug the filter faster, despite maintaining the fluidity of the fuel. It is also important to note that if HFDF is added too much, the additive will not be able to affect all paraffin molecules, which will reduce the effectiveness of its action.

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SYNTHESIS OF ARENDIAZONIUM TOSYLATES CONTAINING TETRAALKYLAMMONIUM GROUPS TO CREATE NEW ANTIBACTERIAL MATERIALS

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The design issues of new materials with programmable surface properties are one of the most important tasks for modern chemical science [1]. In this area, special attention is paid to materials with controlled charge characteristics, since they cause interaction of the material with the environment [2]. These include the positive charge on the surface that determines the interaction with bacterial cells, including pathogens [3].

The modification of the arendiazonium salt molecule with the tetraalkylammonium group will potentially make it possible to obtain materials with

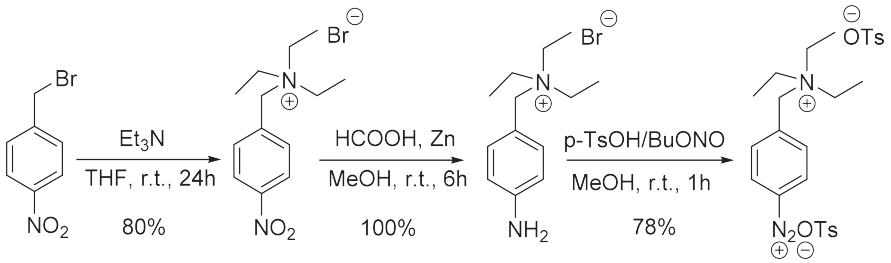

Fig. 1. *Scheme of the synthesis of 4-((triethylammonio)methyl)benzenediazonium ditosylate*

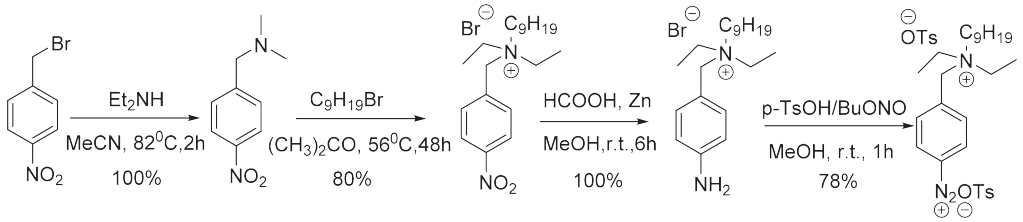

Fig. 2. *Scheme of the synthesis of 4-((diethylnonylammonio)methyl)benzenediazonium ditosylate*

a positive charge. This effect can be used in many applied problems of organic chemistry, sensors technology, modification of materials to give them antibacterial properties. However, to date, methods for the synthesis of such diazonium salts have not yet been developed.

We have developed a method for the synthesis of diazonium salts with tetraalkylammonium groups using alkylation and quaternization reactions. The high selectivity of the method made it possible to obtain tetralkylammonium groups while maintaining the aromatic amine in the structure, which is necessary for further diazotization. Subsequently, the obtained arendiazonium tosylates were used to modify the surface of carbon quantum dots and give them antibacterial properties. Schemes for the preparation of aromatic diazonium salts with various functional groups are presented in Fig. 1 and Fig. 2.

The multistage synthesis is effective and has high practical yields. We are currently studying the limits of synthetic applicability.

Thus, the developed method for the synthesis of aromatic diazonium salts containing a tetraalkylammonium group opens up new possibilities in the design of new materials with desired properties.

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