obtained on the basis of oligomers α - olefins $C_8$-$C_{12}$ [46-48].

**Table-5.** Individual hydrocarbon composition of light gas oil from oxidative cracking of fuel oil M-100 from AGPP on a catalyst based on fly ash from thermal power plants with the addition of Tayzhuzgen zeolite activated by ion exchange (simultaneously with $La^{3+}$ and $NH_4^+$ ions). Cracking conditions: $\omega_{suspension}$ = 1.0 $h^{-1}$, $\omega_{air}$ = 0.15 $h^{-1}$, 0.2 wt.% in raw material, T = 470°C.

| No | Hydrocarbons | Content, % |
|---|---|---|
| 1 | heptene-1, $C_7H_{14}$ | 1.92 |
| 2 | heptane, $C_7H_{16}$ | 2.82 |
| 3 | octene-1, $C_8H_{16}$ | 0.69 |
| 4 | octane, $C_8H_{18}$ | 1.30 |
| 5 | nonene-1, $C_9H_{18}$ | 0.67 |
| 6 | nonan, $C_9H_{20}$ | 1.07 |
| 7 | decene-1, $C_{10}H_{20}$ | 0.83 |
| 8 | decane, $C_{10}H_{22}$ | 1.37 |
| 9 | undecene, $C_{11}H_{22}$ | 1.01 |
| 10 | undecane, $C_{11}H_{24}$ | 1.43 |
| 11 | pentylcyclohexane, $C_{11}H_{22}$ | 0.77 |
| 12 | dodecene-1, $C_{12}H_{24}$ | 1.26 |
| 13 | dodecane, $C_{12}H_{26}$ | 2.24 |
| 14 | 1-butyl-2-pentylcyclopropane, $C_{12}H_{24}$ | 0.65 |
| 15 | 2,6-dimethylundecane, $C_{13}H_{28}$ | 0.70 |
| 16 | tridecene-1, $C_{13}H_{26}$ | 1.25 |
| 17 | tridecane, $C_{13}H_{28}$ | 2.70 |
| 18 | 3-tetradecene, $C_{14}H_{28}$ | 1.31 |
| 19 | tetradecane, $C_{14}H_{30}$ | 2.88 |
| 20 | 3-methyltetradecane, $C_{15}H_{32}$ | 0.63 |
| 21 | 2,6,1-trimethyldodecane, $C_{15}H_{32}$ | 0.51 |
| 22 | 1- pentadecene, $C_{15}H_{30}$ | 1.09 |
| 23 | pentadecan, $C_{15}H_{32}$ | 3.36 |
| 24 | 1-hexadecene, $C_{16}H_{32}$ | 0.99 |
| 25 | hexadecane, $C_{16}H_{34}$ | 3.29 |
| 26 | 2-methylhexadecane, $C_{17}H_{36}$ | 0.72 |
| 27 | 5-heptadecene, $C_{17}H_{34}$ | 0.77 |
| 28 | heptadecane, $C_{17}H_{36}$ | 3.47 |
| 29 | 2,6,10,14-tetramethyltetradecane, $C_{18}H_{38}$ | 1.43 |
| 30 | 2,6,11-trimethylpentadecane, $C_{18}H_{38}$ | 0.70 |
| 31 | 2,6,10-trimethylpentadecane, $C_{18}H_{38}$ | 0.53 |
| 32 | 1-octadecene, $C_{18}H_{36}$ | 1.02 |
| 33 | octadecane, $C_{18}H_{38}$ | 3.96 |
| 34 | 2- methyloctadecane, $C_{19}H_{40}$ | 2.42 |
| 35 | 2,4- dimethylheptadecane, $C_{19}H_{40}$ | 1.60 |
| 36 | nonadecane, $C_{19}H_{40}$ | 4.88 |
| 37 | 6- propylheptadecane, $C_{20}H_{42}$ | 1.82 |
| 38 | 2-methylnoneadecane, $C_{20}H_{42}$ | 1.15 |
| 39 | 3-methylnoneadecane, $C_{20}H_{42}$ | 0.93 |
| 40 | eicosan, $C_{20}H_{42}$ | 6.55 |
| 41 | 3-methyleicosane, $C_{21}H_{44}$ | 1.76 |
| 42 | heneicosane, $C_{21}H_{44}$ | 6.63 |
| 43 | 5- propylnonadecane, $C_{22}H_{46}$ | 2.82 |
| 44 | docosane, $C_{22}H_{46}$ | 5.05 |
| 45 | 3-butylnonadecane, $C_{23}H_{48}$ | 1.96 |
| 46 | tetracosan, $C_{24}H_{50}$ | 3.13 |
| 47 | pentacosane, $C_{25}H_{52}$ | 2.49 |
| 48 | heptacosane, $C_{27}H_{56}$ | 1.17 |

## CONCLUSIONS

The purpose of this work was to study the possibility of using hollow microspheres based on fly ash from the Ekibastuz coal deposit (Kazakhstan), obtained as a result of the operation of TPP-2 in Almaty, for purification of waste gases from sulfur dioxide to produce sulfonic acid and sulfoxides as reaction products. Optimum sizes of active parts of the catalyst are 40-50 nm. A catalytic method of sulfur compounds oxidation by oxygen in an aqueous solution have been developed. Multiple circulation of the aqueous solution makes it possible to obtain 60-70% solution of sulfoacids in the form of a commercial product. It has been found out that microspheres of fly ash are highly effective sorbents of $SO_2$ and low-temperature catalysts of oxidation of $Na_2SO_3$ with oxygen in water solutions. Obtained results have demonstrated that with gas feed speed of 10,000-15,000 $h^{-1}$ degree of removal of $SO_2$ reaches 94.9%. The catalysts synthesized in this work based on fly ash cenospheres with addition of natural zeolite were also tested in the process of catalytic cracking of heavy oil raw materials (with preliminary electromagnetic excitation of hydrocarbon molecules) to obtain light carbon fractions. As a result of the M-100 fuel oil cracking reactions, the final light gas oil contains a significant amount of α - olefinsю A single-stage method for producing α - olefins by cracking affordable and cheap raw materials-fuel oil on catalysts from natural Kazakhstan raw materials could make it possible to master the production of synthetic oils, which is new for Kazakhstan.

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