International scientific and practical conference
«ENERGY SYSTEMS AND ALTERNATIVE ENERGY SOURCES»

Section 11: Greening of energy systems. Energy and the environment. Energy-saving technologies.

BIODIESEL FUEL AS A WASHING OIL TO IMPROVE COKE OVEN GAS QUALITY

National Technical University Kharkiv Polytechnic Institute
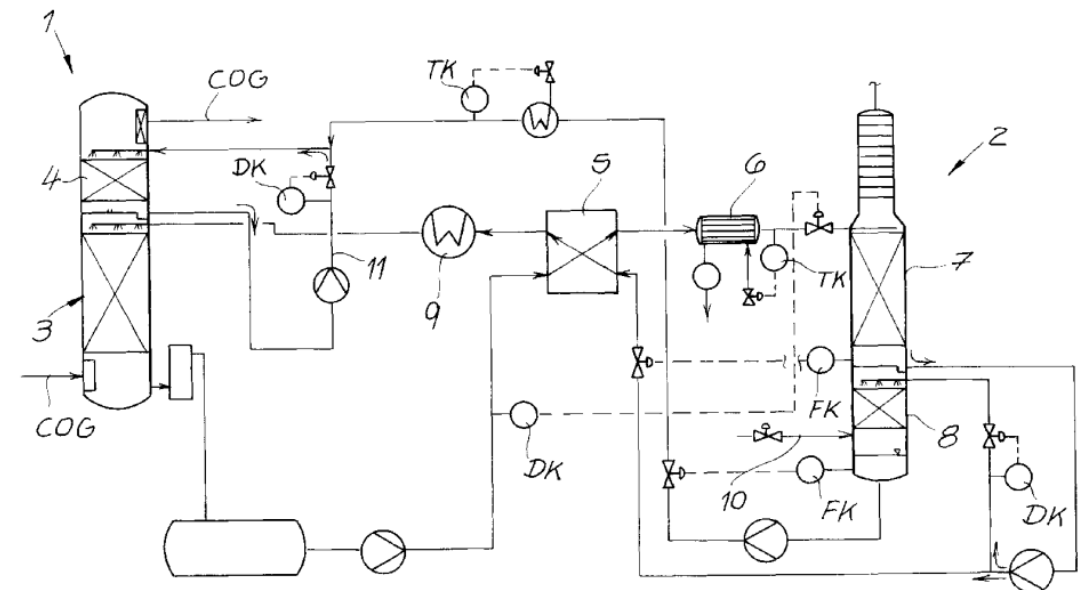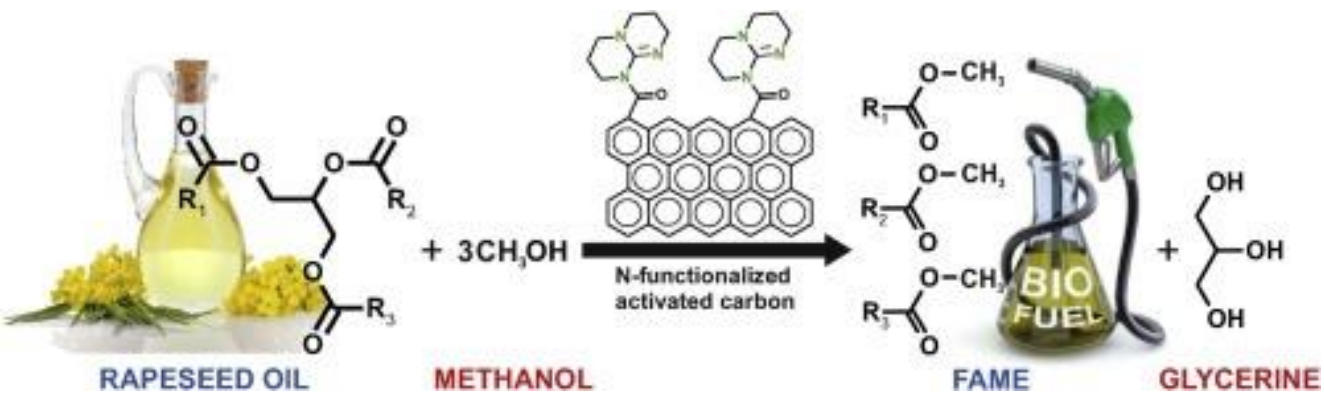
BANNIKOV ARTEM LEONIDOVICH

postgraduate student

KHARKIV 2024

RAPESEED-BASED BIODIESEL:

- bio fuel

- absorbent for cleaning coke oven gas from benzene hydrocarbons

TASK OF THE STUDY: is biodiesel fit for naphthalene absorption?

Traditional absorbent: coal tar wash oil

**Proposed absorbent: biodiesel fuel**

- multicomponent mixture with low boiling point;
- wide distillation interval (230-300 °C);
- high transfer of light absorbent fraction to the obtained crude benzene;
- the presence of naphthalene 5-16 %;
- relatively high operating stability.

- higher boiling point;
- very narrow distillation interval;
- low transfer of light absorbent fraction to the obtained crude benzene;
-absence of naphthalene;
- operating stability ???

Experimental determination of equilibrium for the system "biodiesel – naphthalene"
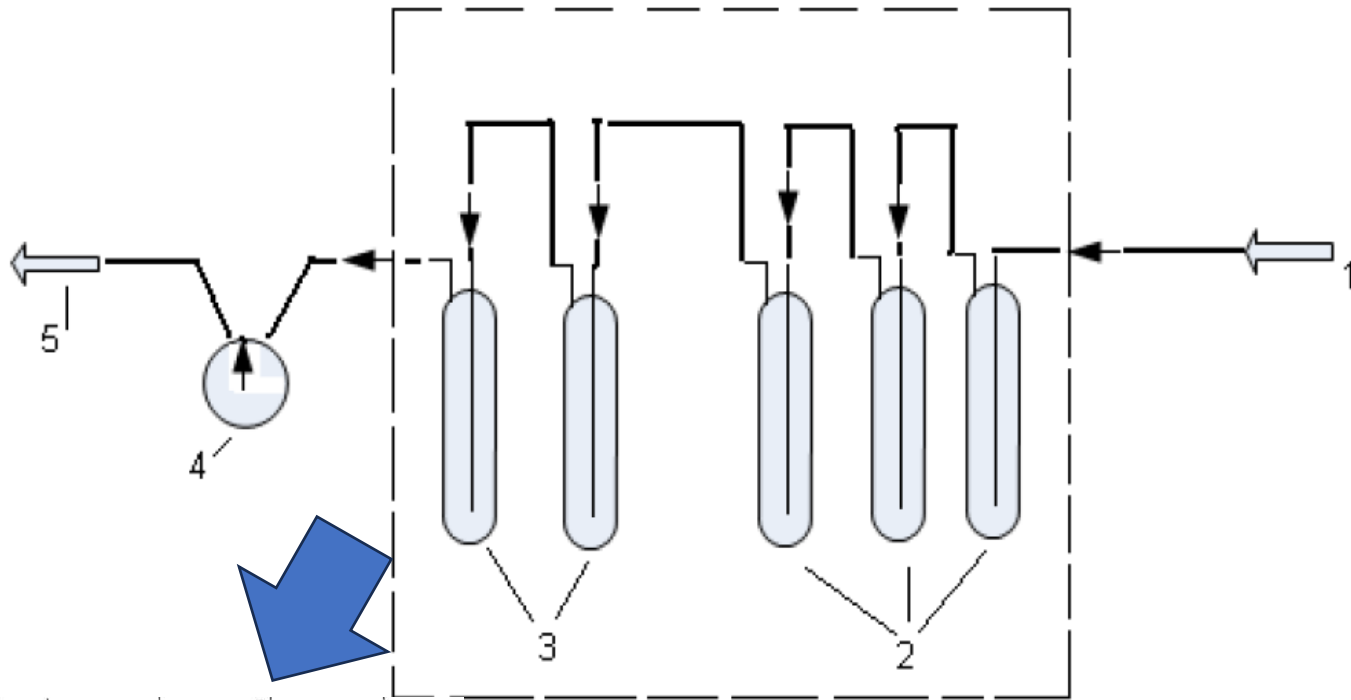
1- inert gas inlet;
2- thermostated flasks with naphthalene solution in biodiesel;
3- thermostated flasks with xylene for naphthalene chromatographic estimation;
4- gas meter;
5- gas outlet
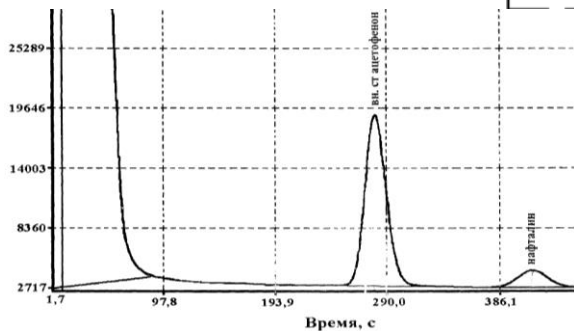
Formulas for calculation of equilibrium concentrations of naphthalene in the liquid phase

$$p = p_0 \times x,$$

where p – partial pressure of naphthalene over the absorber solution, Pa;

p_0 – pressure of saturated vapour of naphthalene over pure naphthalene, Pa;

x – mole fraction of the substance in the solution.

$$\ln X = \frac{L_f \left(T - T_A\right)}{R T T_A}$$

where X – mole fraction of substance in solution A; L_f – molar heat of fusion (crystallisation) of a substance A, kJ/kg-mol; T – process temperature, K; T_A – melting point of the pure substance A, K; R – gas constant, 8.31447 kJ/kg mol K.
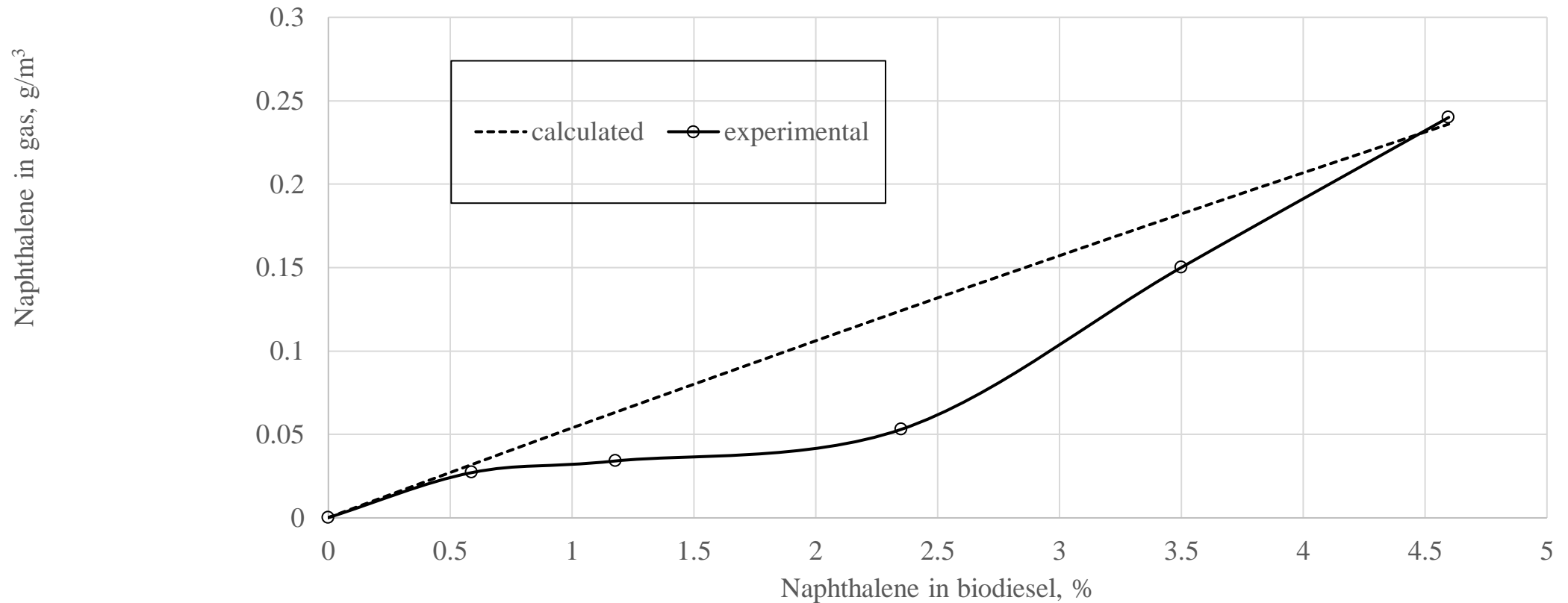
$$\lg p = A - \frac{B}{C + t} + 2{,}1238,$$

where p is pressure, Pa; t - temperature, °C.

The values of coefficients for naphthalene in the temperature range 0 - 80.27 °C are: A=5.8010; B=978.66; C=118.39.
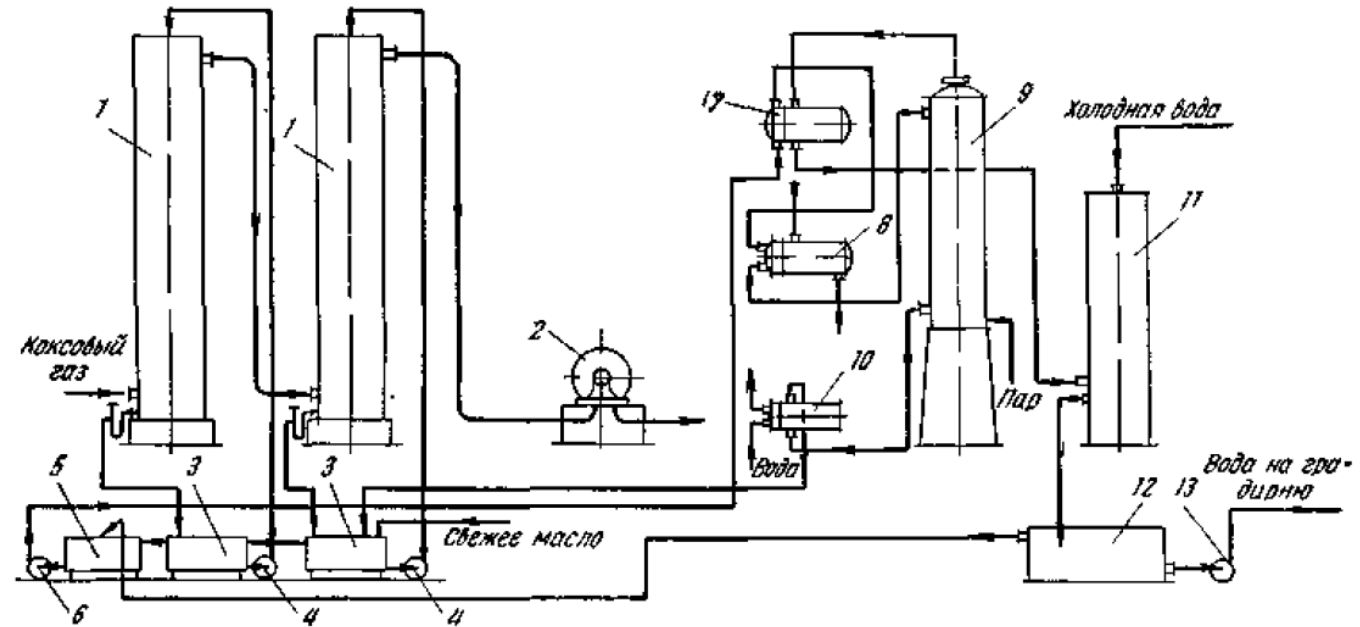
$$p_s = p_o \times N_{max}$$

where N_{max} – molar fraction of naphthalene in saturated solution

Experimental and calculated values of equilibrium concentrations of naphthalene over biodiesel at 25 °C

Comparative characterisation of different naphthalene absorbents

Mass fraction of naphthalene in solution, %	Equilibrium concentration of naphthalene in gas at 25 0C, g/m^3			
	Solar oil	Biodiesel	Anthracene oil	Tetralin oil
1.0	0.04	0.045	0.02	0.015
2.0	0.08	0.090	0.05	0.025

CONCLUSIONS

As a result of the performed work, it was experimentally established that the absorption capacity of biodiesel fuel in relation to naphthalene is comparable to that of solar oil, but unlike the latter, it does not form sludge when interacting with coke oven gas tars. Such combination of absorber properties allows to recommend it for additional treatment of coke oven gas from naphthalene

THANK YOU FOR YOUR ATTENTION!