It is possible to get it at low cost and in the shortest time by extracting it from the total composition of natural gases where the percentage of methane is 70–98 % [3]. But we propose the most efficient way which is also beneficial for the environment – to extract methane from industrial wastes. The proposed technology comprises sorting gases coming out from factories in the form of liquids by condensation. It is similar to the decomposition of oil into its constituent substances in the rectification tower by heating [4]. But our method provides decomposition of gases by condensing. As the temperature of condensation temperature of the gases forming part of the natural or waste gases is lower than –100 °C, it will be more rational to use refrigerants for cooling.

Conclusion

Methane has great prospects as the optimal fuel for the rockets of the future. Perhaps in time the humanity will discover neighboring planets and even become a multi-planetary race, settled on them, using space rockets with methane engines. The today's challenge to achieve it is the development of equipment for collecting methane from different sources including industrial wastes.

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SYNTHESIS OF MODIFIED AROMATIC PETROLEUM RESINS

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One of the fundamental treatment processes of raw hydrocarbons is pyrolysis. Liquid by-products are formed up to 20 % mass. It is known, to have synthesized petroleum resins (PR) from liquid pyrolysis products is the most rational way to increase the oil refining depth [1].

To improve both of the physico-chemical properties and the range of application PR are modified by different agents: ozone, hydrogen peroxide, maleic acid, etc. [2–4].

The aim of this research was a nitration of petroleum resins of the C_9 fraction, which was produced by "Angarsk Petrochemical Company".

In this study, 3 types of petroleum resins and their modified products are considered. The samples of petroleum resins were obtained by radical polymerization with thermal (PRC_9therm) and chemical (PRC_9in) initiation and ionic (PRC_9ion) polymerization. Radical polymerized resins were produced by OOO "Omsk-polymer" and ionic polymerized resin was produced by authors.

Ionic polymerization of the C_9 was carried out with the $TiCl_4 : Al(C_2H_5)_2Cl$ catalyst in a 1 : 1 molar ratio at a temperature of 80 °C for 2 hours [5]. $TiCl_4$ was used in 2 % mass of total weight of the C_9 fraction. After polymerization the catalyst complex was deactivated with a 10 % excess of propylene oxide.

The modification was abided by the standard procedure for aromatic compounds [6]. Procedure of nitration of 30 % resin solution in chloroform was carried out at a temperature of 70 °C within 3 hours by two nitrating agents: 1) concentrated nitric acid (product – N-PR); 2) a mixture of concentrated nitric and sulfuric acids in a molar ratio of 1 : 1 (prod-

Table 1. Value of acid (AN) and bromine (BN) numbers of PR_{C9}

PR characteristic	Thermal polymerization		Initiated polymerization		Ionic polymerization	
	AN, mg KOH/g	BN, mg Br_2/g	AN, mg KOH/g	BN, mg Br_2/g	AN, mg KOH/g	BN, mg Br_2/g
PR_{C9}	1.8	42.8	3.9	45.9	2.0	43.0
$N–PR_{C9}$	22.1	2.2	14.1	3.6	15.4	13.6
$NS–PR_{C9}$	–	1.9	–	2.1	–	7.6

uct – NS-PR). The nitrating agent was added in an amount of 30 % by weight of the resin. The solvent and unreacted products were extracted from the reaction mixture under decreased pressure.

The process was controlled by IR spectroscopy. The appearance of new bands with vibration frequency at 1550–1600 cm^{-1} region indicates the addition of NO_2-groups in the resin composition.

The process of resin oxidation proceeds simultaneously with nitration, which confirms the increase of signals with absorption band at the areas of 1030–1050 and 1130–1160 cm^{-1}.

Acid and bromine numbers of the obtained resins were determined by standard titrimetric methods [6]. The results are shown in Table 1.

As a result of the research, sample of PRC_9ion and nitrated petroleum resins were obtained. The appearance of peaks with banding vibration at 1550–1600 cm^{-1} region and the increasing of values of bromine and acid numbers confirm functionalization at double bonds.

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NEW METHOD OF DIARYLIODONIUM SALTS SYNTHESIS BY OXIDIZING REAGENT OXONE

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Polyvalent iodine reagents found wide application in organic synthesis as environmentally friendly oxidizing reagents, mainly because of its low toxicity, availability, stability on air and humidity resistance. At the same time these substances are an excellent alternative to such heavy metals as lead (IV), tallium (III) and copper (II) [1].

One of the most well characterized polyvalent iodine substances are diaryliodonium salts which have found application as synthetic reagents and biologically active agents.

Simple "one – pot" synthesis of diaryliodonium salts includes treatment of aryl iodide with commercially available oxidizing reagent in the presence of the substitute arene and the corresponding acid or salt which counter – anion finishes the preparation of target product [2].

For carrying out of above-mentioned process can be used mild, inexpensive, easy to use and environmentally friendly oxidizing reagent which main active component is potassium monopersulphate as the constituting threefold salt with a formula $2KHSO_5 \times KHSO_4 \times K_2SO_4$ (also known as Oxone) [3]. As sources of counter – anions have also been used such inexpensive reagents as KBr and TsOH.

The reaction pathway is shown in the figure 1.

Owing to the good leaving ability of bromide and tosylate groups this diaryliodonium salts are