educational institutions, namely, the assimilation of knowledge about hazardous factors of the main types of future professional activity, conditions of career choices for safety and health. In addition, the development of skills to relate individual characteristics with the requirements of professions to comply with health and safety should be considered. The future employee must clearly understand the nature of performed work in the chosen industry, the presence of harmful and dangerous production factors, the possibility of accidents, the frequency of accidents and occupational diseases, and as a result, the culture of health and safety will become the necessary imperative, personally meaningful characteristic for specialists.

After the analysis of motivational influences of employment in hazardous conditions, it was found that the benefits, estimated as socially protecting employees (early retirement, extended leave, additional payments for harmful working conditions) do not carry out their mission, and often reproduce employment in hazardous working conditions. This fact clearly allows to identify the existence of the deficit of safety culture, the lack of value orientations and valuable attitude to health, which requires the development of new pedagogical approaches and mechanisms for creating health and safety culture, acquiring and developing health-motivation of workers employed in hazardous occupations.

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UDC 547.652: 541.123.3

THE ANALYSIS OF SIMULTANEOUS SOLUBILITY OF NAPHTHALENE IN ALCOHOLS AND HYDROCARBONS

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The present study considers simultaneous solubility of naphthalene in alcohols and hydrocarbons , together with critically selected literature data. The prediction of simultaneous solubilities of naphthalene in alcohols and hydrocarbons is of great importance in refineries and petrochemical plants in the design, control and optimization of products and processes.

Naphthalene is produced commercially from either coal tar or petroleum. Naphthalene has long been produced by the destructive distillation of high-temperature coal tars, called carbonization or coking. Coal tar was the traditional source of naphthalene until the late 1950s when it was in short supply, and the generation of naphthalene from petroleum by dealkylation of aromatics-rich fractions from reforming and catalytic cracking became commercially viable. In 1960, the first petroleum–naphthalene plant was brought on stream in the USA and, by the late 1960s, petroleum-derived naphthalene accounted for over 40% of total US naphthalene production. The availability of large quantities of ortho-xylene during the 1970s undercut the position of naphthalene as the prime raw material for phthalic anhydride. In 1971, 45% of phthalic anhydride capacity in the USA was based on naphthalene, as compared with only 29% in 1979 and 17% in 1990. The last dehydroalkylation plant for petroleum naphthalene was shut down late in 1991 [1]. World production of naphthalene in 1987 was around one million tonnes; about onefourth came from western Europe (210 thousand tonnes), one-fifth each from Japan (175 thousand tonnes) and eastern Europe (180 thousand tonnes) and one-eighth from the USA (107 thousand tonnes). In 2000, over 90% of naphthalene in the USA was produced from coal tar; most naphthalene in western Europe was produced from coal tar; and all naphthalene produced in Japan was from coal tar [2]. The main use for naphthalene worldwide is the production of phthalic anhydride by vapour-phase catalytic oxidation, particularly in Japan and the USA, where this accounted for 73% and 60% of naphthalene demand, respectively, in 1999. Phthalic anhydride is used as an intermediate for polyvinyl chloride plasticizers, such as di (2-ethylhexyl) phthalate. Naphthalene is also used in the manufacture of a wide variety of intermediates for the dye industry; in the manufacture of synthetic resins, celluloid, lampblack and smokeless powder; and in the manufacture of hydronaphthalenes (Tetralin (tetrahydronaphthalene), Decalin (decahydronaphthalene)) which are used as solvents, in lubricants and in motor fuels [1-3]. Naphthalene sulfonates represent a growing outlet for naphthalene. The products are used as wetting agents and dispersants in paints and coatings and in a variety of pesticides and cleaner formulations. Naphthalene is also a starting material for the manufacture of 1-naphthyl-N-methylcarbamate (carbaryl), an insecticide, and several other organic compounds and intermediates [1-2]. The use of naphthalene as a moth-repellent and insecticide is decreasing due to the introduction of chlorinated compounds such a para-dichlorobenzene. In 2000, about 6500 tonnes of naphthalene were used (in Japan (1100 tonnes), the USA (450 tonnes) and Europe (5000 tonnes)), in moth-proofing and fumigation. Another new use for naphthalene is in production of polyethylene naphthalene for making plastic beer bottles. It has also been used in veterinary medicine in dusting powders, as an insecticide and internally as an intestinal antiseptic and vermicide [1-4]. Consumption of naphthalene by major region in selected years is presented in Table.

Consumption of naphthalene by major region (thousand tonnes)

End use	Japan		USA		Western Europe	
	1995	1999	1995	2000	1995	2000
Phthalic anhydride	137	124	66	66	42	45
Naphthalene sulfonates	16	9	21	27	34	45
Pesticides	2	I	17	14	15	22
Dyestuff intermediates	22	23	-	-	14	11
Other	16	15	2	3	14	10
Total	193	172	106	109	119	133

Naphthalene is a valuable raw material for the chemical industry and is used for producing colourants and explosives. Naphthalene is also used in medicine.

The representation of the mutual solubilities of naphthalene in alcohols and hydrocarbons with theoretically sound models is still an interesting challenge in thermodynamics.

Several empirical expressions for predicting the simultaneous solubilities of naphthalene-alcohol and naphthalene-hydrocarbon systems have been proposed in literature [5]. The patterns of change in the solubility of naphthalene in different alcohols and hydrocarbons at temperatures ranging from 20 to 70 ° C were identified in order to expand the data on the physicochemical characteristics of naphthalene, in particular 9[5]. The solubility was determined by the conventional method.

Comparative analysis of the results allowed us to establish the following consistent patterns:

1. The solubility of naphthalene in saturated hydrocarbons decreases with increasing of the chain's length (from C_6H_{14} to $C_{16}H_{34}$) in the investigated range of temperature.

2. The hydroxyl group which was introduced into the molecule of the hydrocarbon enhances the solubility of naphthalene (for example, hexane, hexanol, benzene and benzyl alcohol). An increase in solubility of naphthalene with increase of its molar mass is characteristic for alcohols, unlike hydrocarbons.

3. In the hydrocarbons with branched side chain the solubility of naphthalene is lower than in normal structure of the substances and it decreases with increasing in number of branches. It is also possible to apply this rule to hydrocarbons (for example, octane, and isooctane) and to alcohols (butanol, isobutanol, tert-butyl alcohol, propanol, and isopropyl alcohol).

4. In the cyclic hydrocarbons the solubility of naphthalene is better than in open chain hydrocarbons, (for example, hexane, cyclohexane) but for alcohols the situation is reversed, the solubility of naphthalene in hexanol is higher than in cyclohexanol.

5. The solubility of naphthalene in hydrocarbons, with the appearance of aromatic rings in their molecule and the growth in their number, increases (for example hexane and benzene, decalin and tetralin, but in alcohols the situation is reversed, the solubility decreases (for example hexanol and phenylmethanol.

The prediction of simultaneous solubilities of naphthalene in alcohols and hydrocarbons is of great importance in refineries and petrochemical plants in the design, control and optimization of products and processes.

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