

Effect of petroleum type on properties of asphalt and asphalt-aggregate mixtures

T. J. Erbitu¹, J. Blazek¹, G. Sebor¹, D. Maxa¹, A. Zemankova² and F. Luxemburk²

¹ *Department of Petroleum Technology and Petrochemistry, ICT, Technicka 5, Prague 6* ² *Faculty of Civil Engineering, Czech Technical University in Prague, Zikova 4, Prague 6*

Abstract. Semi-blown asphalts of the grade 70/100 according to the standard EN 12591 were prepared from crude oil Ural, Oseberg, and Sahara. The asphalts prepared were analysed and then used to make asphalt-aggregate mixtures ABH I. Rheological properties of the mixtures were evaluated using Nottingham Asphalt Tester (NAT), also their resistance to freezing/defreezing procedure was assessed using Marshall test. The influence of raw materials on properties of resultant asphalt-aggregate mixtures is discussed in the paper presented.

Key words: asphalt-aggregate mixture; properties; Nottingham Asphalt Tester

Effect of vacuum gas oil hydrogenation upon hydrogen donor solvent hydrovisbreaking of vacuum residue

D. Kubicka, J. Blazek, R. A. Aswad, G. Sebor and D. Maxa*

Department of Petroleum Technology and Petrochemistry, Institute of Chemical Technology Prague, Technicka 5, 166 28 Praha 6, Czech Republic

* Present address: VÚANCH a.s, 436 70 Litvínov, Czech Republic **Abstract.** Influence of hydrogenation of the vacuum gas oil (VGO) added in 20 wt% quantity to the vacuum residue (VR) on the quantity and properties of hydrovisbreaking (HVB) products of this raw material was studied. Autoclave HVB experiments were made at the temperature range of 395_415°C, in the reaction time of 1 hour and hydrogen pressure of approx. 20 MPa. Reaction products were distilled into gasoline (fraction boiling up to 185°C), gas oil (fraction boiling in the range of 185_360°C) and a residue boiling above 360°C. In the hydrovisbreaking of VR with the addition of HVGO (hydrogenated VGO), practically the same amounts of gases, gasoline, gas oil and the atmospheric residue occurred as in the hydrovisbreaking of VR with the addition of VGO. **Key words:** visbreaking, hydrogenation, vacuum gas oil, vacuum residue.

Influence of the vessel dimension on the properties of liquid water depending on its upper molecular structure

J. Polakovic

Departement of Physical Chemistry, Faculty of Chemical and Food Technology, Slovak University of Technology, SK-812 37 Bratislava e-mail: polakovi@chtf.stuba.sk

Abstract. The properties of liquid water, depending on its upper molecular structure, were studied by Po-method. Commonly is supposed that these properties do not depend on the dimensions of the vessel in which the water is situated. To check up this assumption special cylindrical vessels were constructed : 3 made of simax glass with inner diameter of 35,5 mm; 1 made of simax glass with inner diameter of 14,5 mm; 1 made of stainless steel with inner diameter of 14,5 mm.

Key words: properties of liquid water, upper molecular structure of liquid water, charging current, electric

double layer, special vessels, electro magnetic shield.

Vacuum residue hydrovisbreaking in the presence of trace amount of molybdenum hexacarbonyl

R. A. Aswad, J. Blazek, D. Maxa and G. Sebor

Department of Petroleum Technology and Petrochemistry, Institute of Chemical Technology, Technicka 5, Prague 6, 166 28, Czech Republic

Abstract. The effect of hydrogen/feed ratio was studied upon hydrovisbreaking of petroleum vacuum residue from the crude oil Ural (Russia). Both non-catalytic and catalytic mode of hydrovisbreaking was carried out in laboratory autoclave in the temperature range from 405 to 420 °C. As a catalytic additive, molybdenum hexacarbonyl was added into the feed for catalytic experiments. The reaction products were separated by distillation and solvent extraction; obtained fractions were further analytically evaluated. Conversions of raw material into distillates, as well as quality of the products were evaluated. In the studied range of reaction temperatures the presence of Mo catalyst caused a decrease of conversion into distillates boiling up to 460 °C. An increase of hydrogen/feed ratio has no significant effect in both catalytic and non-catalytic mode of experiments.

Key words: petroleum vacuum residue, hydrovisbreaking, catalyst, evaluation

MOLECULAR WEIGHT AND POLYDISPERSITY OF ASPHALTIC COMPONENTS SEPARATED FROM SOME INDIAN CRUDE OILS

S. K. Khanna¹, H. U. Khan¹, S. S. Sawhney², K. M. Agrawal¹, and C. D. Sharma¹

¹ Indian Institute of Petroleum, Dehradun _ 248 005, India ² D A V (PG) College, Dehradun-248 001, India

Abstract. Molecular weight and polydispersity of asphaltic components separated from Indian crude oils using different solvents have been determined. Role of solvent and crude oil composition on these properties have been determined. The study indicated that number average molecular weight of these asphaltic components determined by VPO and GPC differ greatly.

Key words : Heavy crude, asphaltenes, GPC, VPO, molecular weight.

Comparison of vacuum residue visbreaking and hydrovisbreaking

D. Maxa, F. Prochaska, G. Sebor, J. Blazek and J. Kroufek

Department of Petroleum Technology and Petrochemistry, Institute of Chemical Technology, Technicka 5, Prague 6, 166 28, Czech Republic

Abstract. Visbreaking and hydrovisbreaking experiments were carried out in laboratory rotating autoclave. Experiments were performed at reaction temperature from 395 °C to 415 °C, reaction time of 1 hour, and pressure of 20 MPa. Conversion of petroleum vacuum residue to gases, gasoline and gas oil was calculated and the fractions were analysed. Besides distillation, fractional composition of products was also assessed

by simulated distillation using high-temperature capillary gas chromatography. Yields and quality of products obtained at visbreaking and hydrovisbreaking were compared.

Key words: visbreaking, hydrovisbreaking, petroleum vacuum residue

DETERMINATION OF AROMATIC HYDROCARBONS USING HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY

J. Kroufek, M. Pospíšil, P. Simacek, G. Sebor and Z. Fiedlerova

Department of Petroleum Technology and Petrochemistry, Institute of Chemical Technology, Technická 5, 166 28 Prague 6, Czech Republic

Abstract. The article deals with problems of group-type analysis of middle petroleum fractions using high performance liquid chromatography (HPLC) with refractive index (RI) and/or ultraviolet (UV) detectors. The main experimental work was focused on a selection of suitable chromatographic column and calibration of both detectors. Series of mono-, di- and polyaromatic standards as well as aromatic fractions prepared from real petroleum samples using preparative liquid chromatography were tested for the calibration purposes. Group-type analysis of four middle petroleum samples (diesel fuels and kerosene) was finally performed. Results of HPLC group-type analysis were compared with those of preparative liquid chromatography. The use of UV detector can mainly be recommended for determination of low concentrations of polyaromatic hydrocarbons.

Key words: HPLC, group-type analysis, middle petroleum distillates, diesel fuel

Development of a New Laboratory Oxidation Test for Engine Oils

J. Cerný, D. Landtova and G. Sebor

Department of Petroleum Technology and Petrochemistry, Institute of Chemical Technology, Technická 5, 16628 Prague, Czech Republic

Abstract. A new oxidation test for evaluation of thermal oxidation stability of engine oil was developed. It is based on the standardised IP 48 test that was originally proposed for base oils. Optimised parameters of the test were as follows: oxidation medium, flow rate, and oxidation time. Oxidation temperature was kept at 200 °C to maintain the high-temperature character of the oxidation. Reproducibility of the new oxidation test was also evaluated. The new test is suitable for engine oils of the API SF and CC up to API SH/SJ and CF classification.

Keywords: engine oils, oxidation, stability, oxidation test

On physical origin of Noncovalent interactions in acetylene dimers

V. Lukes¹ and M. Breza²

¹*Department of Chemical Physics, Faculty of Chemical and Food Technology, Slovak Technical University, SK-81237 Bratislava, Slovakia, e-mail: lukes@chtf.stuba.sk* ²*Department of Physical Chemistry,*

Faculty of Chemical and Food Technology, Slovak Technical University, SK-81237 Bratislava, Slovakia, e-mail: breza@cvt.stuba.sk

Abstract. The van der Waals acetylene dimers are studied by supermolecular ab initio treatments using medium-large basis sets with inclusion of correlation energy as well as basis set superposition error corrections. Very good agreement with experimental data has been obtained when comparing with previous theoretical studies. The energy partitioning using the intermolecular perturbation theory scheme shows different origins of stability of the studied configurations. The higher stability of T-shaped configuration (C_{2v} symmetry) in comparison with the slipped S-one (C_{2h} symmetry) originates in Hartree-Fock deformation (prevalingly induction energy) and dispersion contributions. Our results indicate that aug(d,p)-6-311G** and Sadlej's basis set might produce satisfactory results for larger clusters with low calculation costs.

Key words: Acetylene dimers - Weak molecular interactions - Hydrogen bond - Perturbation theory

RADIOTRACER STUDIES ON ADSORPTION AND DESORPTION OF ZINC IONS ON NATURAL AND CHEMICALLY TREATED ZEOLITES

M. Foldesova¹, P. Dillinger¹, P. Lukac¹ and E. Samajova²

¹ Faculty of Chemical and Food Technology, Slovak University of Technology, Radlinského 9, SK-812 37 Bratislava, Slovak Republic, E-mail: dill@chtf.stuba.sk ² Faculty of Natural Sciences, Comenius University, Bratislava

Abstract. The static radioexchange method was used to monitor the sorption and desorption kinetics of Zn cations into and out of microporous material such as natural and chemically modified zeolites from Slovak Republic and Ukraine. The cation exchange capacity (CEC) of mentioned zeolites was determined. Sorption and desorption of zinc was measured through the radioactivity changes of the solution and sorbed zeolite. The uptake of zinc could be monitored and described. The sorption coefficient m , distribution coefficient K_D and sorption capacity G were calculated. A 25-fold increase in the uptake of zinc was demonstrated by zeolite treated with 6 mol/l aqueous solution of NaOH. Effect of pH on the sorption of zinc was studied at the pH 1, 2, 3, 4, 5 by static radioexchange method as well. The best uptake of zinc by different zeolites was in the pH range 3 - 6,5. The leachability L of zinc from Zn-loaded zeolites was studied as well. The leachability into neutral solution was negligible, into basic solution up 65% and into acidic solutions in the range 38 -90%.

Key words: natural and chemically modified zeolites, sorption, desorption, zinc, static radioexchange method, AAS method

Oxidative coupling of methane

R. Svitan, J. Ilkovic, E. Biskupicova, E. Hajekova and M. Bajus

Faculty of Chemical and Food Technology, Slovak University of Technology, Radlinského 9, 81237 Bratislava, Slovak Republic, e-mail: svitan@chelin.chtf.stuba.sk, ilkovic@chelin.chtf.stuba.sk, ebiskup@yahoo.com, ehajekova@hotmail.com, bajus@chelin.chtf.stuba.sk

Abstract. Finding for substitutable sources for petrochemicals production can reduce speed resource depletion of crude oil. One of potential processes can be Oxidative Dehydrogenation of Methane (ODM). We discover that ODM offer 11% yields of C_2+ hydrocarbons (ethylene, ethane and higher hydrocarbons)

with 7% Li/MgO as a catalyst.

Key words: ethylene, ethane, oxidative dehydrogenation of methane, oxydehydrogenation, methane conversion

CONVERSION OF ACYL GLYCEROLS TO METHYL ESTERS BY TLC METHOD

J. Cvengros¹, Z. Cvengrosova¹ and C. Hoka²

¹Faculty of Chemical and Food Technology STU, Radlinského 9, 812 37 Bratislava, E-mail: cvengros@chtf.stuba.sk ²EKOIL a.s. Grosslingova 45, 811 09 Bratislava, E-mail: hoka@ekoil.sk

Abstract. A simple and fast method - a thin-layer chromatography on Silica gel 60 sheets is used for informative evaluation of conversion of acyls bound in acyl glycerols to methyl esters. Methyl esters prepared by transesterification of vegetable oils and animal fats are used as an alternative fuel in diesel engines. The analytical method is based on comparison of the size of triacyl glycerol spots to standard of known conversion determined through the gas-liquid chromatography. Analysing the equal amounts of sample and the standard enables to determine, whether the degree of conversion of analysed sample is equal, or lower than that of the standard. The method is informative only and can not substitute the exact determination of the degree of conversion by GLC method.

Key words: Methyl esters, Alternative fuels, Diesel fuel substitute, Conversion determination, TLC chromatography

KINETIC AND REACTOR MODELLING OF NAPHTHA REFORMING PROCESS

J. Ancheyta-Juárez^{*1,2}, E. Gonzales¹ and E. Villafuerte-Macias²

¹ Instituto Mexicano del Petróleo, Eje Central Lázaro Cárdenas 152, México 07730 D.F., MEXICO, FAX (+52-5) 3003-8429, E-mail: jancheyt@imp.mx ² Instituto Politécnico Nacional, ESIQIE, México 07738 D.F., MEXICO

Abstract. In this work kinetic and reactor modelling of naphtha reforming process is presented. The kinetic model is an extension of the model reported by Krane et al (1970), and utilizes lumped representation of the reactions that take place. These groups range from one to eleven carbon atoms for paraffins, and from six to eleven atoms of carbon for naphthenes and aromatics. Other reactions that this kinetic model considers are the cyclohexane formation via metylcyclopentane isomerization and paraffins isomerization. The process model is used to predict temperature and reformat composition profiles in a commercial reforming unit. The agreement between predicted and commercially reported results is very good.

Key words: Catalytic reforming, modeling, kinetic model.

Modelling of Combustion Engine Degradation Processes

J. Stodola

The Military Academy, PS 13, FVT-DV, 612 00 Brno, Czech Republic

Abstract. This paper outlines possibilities of combustion engine wear _ process evaluation. The possibilities include the categorization of wear products (adhesive, abrasive, spherical, laminar, fatigue, corrosive, non-ferrous, and other particles) as well as possibilities of trend wear-process evaluation resulting from the deterministic-type balance equations dealing with processes of creation and decrease of wear products in combustion engine lubrication systems. The practical application of the approach to engine_lubricant system wear evaluation has been verified by quantification of a statistically significant collection of engines that utilize possibilities of friction coefficient decrease; selected preparations have been verified. The combustion engine actual technical condition has been evaluated by application of multidimensional statistical evaluation. The model enables description of the quality variable by means of number quantity variables (tribological, ecological, or economical parameters of the engine-lubricant system)

Key words: tribodiagnostic, discriminative analysis, current wear, limit wear, fatigue particles, spherical debris, laminar particles, wear mode, trend evaluation, multidimensional evaluation

ANTHRACITE MODIFICATION AND APPLICATION IN OIL REFINERY ECOLOGY

M. Jovanovic¹, L. Matic² and T. Kostic³

¹ Nis-Oil Refinery Pancevo ² Trayal Corporation Krusevac ³ JLC-Chemie-Austria, Office Belgrade

Abstract . Anthracite is available and cheap domestic crude in Serbia but not enough used in some advanced industrial aim. Its original porous structure is rather poorly developed as a System of open pores in meso (near macro) region. The hydrothermal treatment is simple way to modify porous characteristics. It is well known that steam activation gives microporous structure and higher surface area of sorbents as a function of time and conditions of activation. Short time of activation is preferable from aspects of carbon-sorbent yield. However, the degree of developed porous structure is essential for particular use of sorbent.

In this paper the anthracite Samples from Serbian locality Vrska Cuka were studied as the effective material used as additive to active carbon in MEROX catalyst Support as sorbent for toxic compounds (organic solvents, H₂S, SO₂ etc.) from gas streams and as support for new catalyst for heavy fractions processing.

The steam activation process realised under different conditions (time, temperature) gave hydro anthracite with surface area range between 100-400 m²/g and different distribution of meso- and micro-pores. The porous structure was detected by mercury porosimeter and surface area by BET method.

Key words: anthracite, active carbon, sorbent, catalyst, ecology

Condition monitoring of industrial lubricants

F. Novotny-Farkas and W. Bohme,

OMV Aktiengesellschaft, A-2320. Schwechat, Mannswörtherstrasse 28 e-mail: ferenc.novotny-farkas@omv.com

Abstract. Laboratory investigation were carried out to modernise and up-grade the condition monitoring of different type of industrial lubricants. The Fourier transform infrared (FTIR) spectroscopy offers many advantages as reliable method and a complex tool that has become increasingly role in replacing several traditional methods of lubricant analysis. When sample of reference fresh oil is available for comparison differential infrared spectroscopy can be used to obtain consistent information on the extent of oil degradation or contamination of used oil.

Key words: industrial lubricants, condition monitoring, Fourier transform infrared spectroscopy

Alkylation of benzene by long-chain linear α -olefins over zeolite catalysts

A. Nociar¹, *P. Hudec¹, A. Smieskova¹, T. Jakubik² and Z. Zidek¹

¹ Department of Petroleum Technology and Petrochemistry ² Central laboratories Faculty of Chemical and Food Technology, Slovak University of Technology Radlinského 9, SK 812 37 Bratislava, Slovak Republic * corresponding author

Abstract. Alkylation of benzene by linear α -olefin 1-hexadecene was studied over three types of zeolites with different pore structure: 10-member window ZSM-5 zeolite (structure type MFI), 12-member window mordenite (structure type MOR) and 12-member window Y-zeolite (structure type FAU). The reaction was studied in autoclave at 200°C at the molar ratio of benzene : olefin 8.64:1 and weight ratio of catalyst : reaction mixture 12:1. The results showed that zeolite ZSM-5 is not suitable for this kind of alkylation, mordenite have moderate conversion to alkylbenzenes with high selectivity to 2-hexadecylbenzene (up to 75%). The highest activity for studied alkylation showed Y-zeolite, where even after reaching the reaction temperature the conversion of olefin was nearly 100%.

Key words: alkylation, α -olefins, zeolites, alkylbenzene

Flow Characteristics of some wax lube oil base stock systems

A. K. Gupta and K. M. Agrawal

Indian Institute of Petroleum, Dehra Dun-248005 (UA)-INDIA

Abstract. The effect of wax concentration and composition on viscosity and pour point of lube oil base oil stock and response of viscosity index improver and pour point depressant additives have been investigated.

Key Words: Wax, lube oil base stock, additive