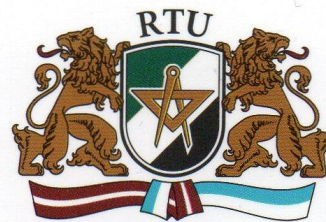


Riga Technical University  
Faculty of Material Science and Applied Chemistry



## **ABSTRACTS**

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<i>Agnese Brangule, Dārta Ūbele, Kārlis Agris Gross</i> Comparison of FTIR Methods for Analyzing Calcium Phosphates .....	36
<i>Inga Dusenkova, Iveta Kusina, Juris Malers, Liga Berzina-Cimdina</i> UV Protection Ability of Latvian Illite Clays .....	37
<i>Aigars Pazhe, Janis Rizhikovs</i> Petroleum Ether - Most Appropriate Solvent for Isolation of Betulin from Birch Outer Bark .....	38
<i>Tatiana Borisova, Ruta Muceniece, Kaspars Jekabsons</i> Adsorption of Aloin on the Surface of Gelatin and Protein of Extracellular Matrix (ECM) of Cells HepG2 and HeLa .....	39
<b>Subsection Materials Science .....</b>	<b>40</b>
<i>Ilmars Zalite, Natalja Zilinska, Ints Steins</i> The Role of the Raw Components on Compacting and Properties of Nanostructured Sialon Materials.....	41
<i>Marija Mašonkina, Gundars Mežinskis</i> Properties of ZrO <sub>2</sub> Thin Films Deposited by Dip-Coating .....	42
<i>Inta Kiriloviča, Inta Vītiņa, Silvija Igaune-Blumberga, Inta Timma</i> Research of Mortars of Historic Buildings in Latvia .....	43
<i>Ieva Zake-Tiluga, Ruta Svinka, Visvaldis Svinka, Tobias Fey</i> Thermal Conductivity of Porous Al <sub>2</sub> O <sub>3</sub> -Mullite Ceramics .....	44
<i>Liga Dabare, Ruta Svinka, Visvaldis Svinka</i> Ammonia Removal from Water Solution by Adsorption on Porous Clay Ceramic Pellets .....	45
<i>Ruta Svinka, Oskars Lescinskis, Visvaldis Svinka</i> Activation of Ceramic Surface with Accelerated Electrons.....	46
<i>Santa Lagzdiņa, Andris Šutka</i> Hydrothermal Synthesis of Iron Oxide Nanomaterials .....	47
<i>Andris Šutka, Mārtiņš Millers, Mārtiņš Vanags</i> Anatase/Spinel Ferrite Visible Light Photocatalytic Active Heterojunctions.....	48
<i>Andris Ozols, Peteris Augustovs, Peteris Studens, Elmars Zarins, Valdis Kokars</i> Coherent Self-Enhancement of Dynamic Gratings in W-75 Molecular Glassy Films .....	49
<i>Jānis Zemītis, Mārtiņš Vanags, Kaspars Kaprāns, Gunārs Bajārs, Jānis Kleperis</i> Electrochemical Studies of Ion Intercalation in Thin Film Nanomaterials .....	50
<i>Pēteris Lesničenoks, Līga Grīnberga, Georg Chikvaidze, Jānis Kleperis</i> Studies of Reversible Hydrogen Binding in Nano-Sized Materials.....	51

# Petroleum Ether - Most Appropriate Solvent for Isolation of Betulin from Birch Outer Bark

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**Keywords** – Birch outer bark, petroleum ether, extraction, betulin.

## I. INTRODUCTION

In the industrial processing of birch wood as a by-product accumulates birch outer bark (BOB) which often is burned as a fuel. However, birch bark can also be a promising raw material for compounds with a very broad range of applications - in the field of pharmaceutical, cosmetic, food and material science. In recent decades, attention of scientists has deserved lupane type pentacyclic triterpenes. Betulin is main representative of triterpenes in BOB. Birch bark comprises about 12.50 wt.% of the tree mass from which up to 3.40 % is outer bark which contains 25 % of betulin. Such a high content of individual compound in natural resources is very uncommon; therefore it makes the isolation of betulin from birch outer bark economically favourable on an industrial scale.

Non-polar hydrocarbons is referred as most selective solvents for isolation of betulin in the extraction process [1]. Therefore, it is necessary to choose the best solvent taking into account important factors such as price, toxicity, etc. Experimental studies showed that the most suitable solvent for the extraction of BOB is petroleum ether with a boiling range of 100–140 °C (PE140). It consists of a mixture of hydrocarbons, mainly of heptane, octane, nonane, decane, with an average density of 0.74 kg/m<sup>3</sup>.

## II. MATERIALS AND METHODS

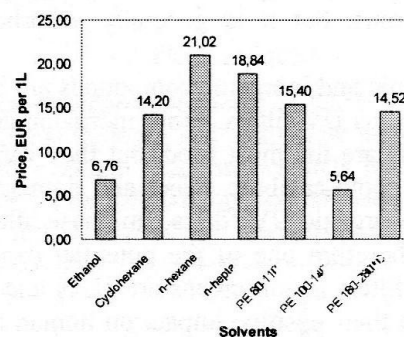
Freshly isolated birch bark, left over at a plywood factory, was chosen as a representative of industrial waste. Milled ( $\leq 2$  mm) and dried (moisture content of 2–4 wt. %) BOB extraction was carried out in Soxhlet apparatus and laboratory scale intensive mass exchange extraction unit [2].

The components were identified with gas chromatography/mass spectroscopy by comparison of the spectra with those of the standards.

## III. RESULTS AND DISCUSSION

BOB extractives and betulin solubility in hydrocarbons increases by increasing solvent temperature, such as PE140 by heating from 20 °C to 104 °C solubility of extractives increases 5.2 times (from 2.7 g/L to 13.9 g/L). Such distinctive solubility can be exploited to obtain betu-

lin with high purity (90–95 %) by applying an intermediate crystallisation method [2]. PE140 is one of the cheapest solvent from common hydrocarbons used for the extraction of betulin; the price is even lower than that for ethanol (Fig. 1). European Medicines Agency recommends petroleum ethers as one of the safest solvents for extraction of pharmaceutical raw materials [3].



**Figure 1.** Comparison of the solvents prices in "Across" catalog per 1 liter (converted from price per 25 L solvent).

In the extractives obtained by PE140, content of admixtures is up to 2.6 times lower than that for ethanol. With PE140 in Soxhlet apparatus can be obtained 27.6 % of extractives where 83.0 % are betulin, 7.2 % lupeol and 9.8 % other admixtures (fats, wax etc.). But by intermediate crystallisation method a content of betulin in extractives can be increased up to 95 %. Further fractional crystallisation using PE140 as a solvent can improve the betulin content above 95 % [4].

Color of the betulin obtained by PE140 is snow white and the structure of the crystals is advantageous for the crystal filtering and grinding processes.

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