EUROPEAN INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH AND MANAGEMENT STUDIES

VOLUME04 ISSUE06
DOI: https://doi.org/10.55640/eijmrms-04-06-02 Pages: 14-17

STUDY OF EXTRACT SUBSTANCES OF WHITE BIRCH BARK

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ABOUT ARTICLE

Key words: Betula Turkestanica Roth, extractives, betulin, lupeol, biological activity.

Received: 01.06.2024
Accepted: 05.06.2024
Published: 09.06.2024

Abstract: The article presents the results of a comparative study of extractive substances and the main substance - betulin content of Turkestan white birch bark, as well as the results of the study of its structure and some physico-chemical parameters. Betula Turkestanica Roth extractives contain 82% betulin.

INTRODUCTION

Despite the fact that the extractive substances contained in the bark of white birch species have been thoroughly and comprehensively investigated for many years, there is no information about the study of the bark of Betula Turkestanica Roth in the literature. Betula Turkestanica Roth and Betula Tianshanica are white birch species endemic to the Uzbeksitan region, growing in separate or mixed forests on the riverbanks and in orchards of the mountainous regions of the republic. It is known that for centuries, people have been preparing tinctures, decoctions and alcoholic tinctures from white birch bark, buds, leaves and young branches, using them to treat various diseases - gout and rheumatic pains, as a bile, diuretic and antiseptic agent. [1].

Today, in practical medicine, their various medicinal forms are used in the treatment of avitaminosis, liver diseases, atherosclerosis, stomach ulcers and other diseases. The composition of white birch bark was thoroughly studied and it was found that it contains lupeol, betulin, betulinic and oleic acids, polyphenols, polysaccharides, flavoring and other substances. The content of the main triterpenoid - betulin in the bark is found to be up to 35% [2, 3]. White birch bark, which is a natural renewable raw material, is considered a source of various individual biologically active substances and is of great importance due to the possibility of developing new highly effective drugs based on them. For the first time in 1788, betulin was isolated from white birch bark by Lowitz by sublimation method, later it was isolated by extraction method and was named betulinol (lup-20(29)-ene-3b,28-diol) in the literature.

Betulin is a lupane-type pentacyclic triterpenoid, the structure of which consists of 4 six-membered and 1 five-membered fused rings, an isoprene residue at C19 (C20=C29), and a diatom containing hydroxyl groups at C3 and C28 alcohol (Fig. 1, a).

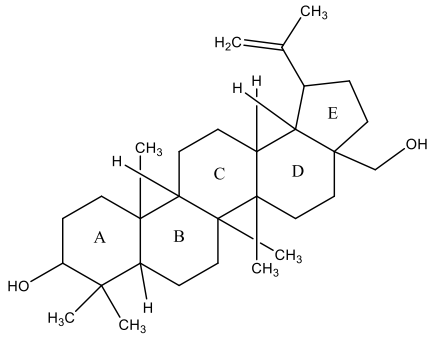
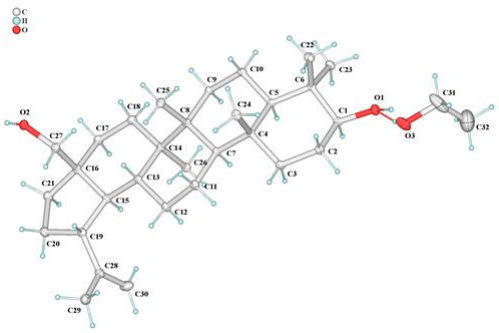


Figure 1. a) Structure of lup-20(29)-ene-3r,28-diol



b) Molecular structure of betulin ethanol crystal solvate obtained by X-ray structural analysis

Analysis of the literature in recent years shows that there is an increasing interest in natural biologically active substances, including terpenoids. Leading scientific centers of the world, extensive research is being conducted on the synthesis of its new derivatives and the study of biological activities [1-6]. Tang J and colleagues have shown that betulin inhibits SREBP protein activity, reduces hyperlipidemia, insulin resistance, and atherosclerotic plaques [4]. SREBP-1 protein is known to be important in the induction of lipogenesis in the liver and is activated in the presence of insulin, causing an increase in the amount of SREBP-1c, which in turn leads to the storage of fatty acids in the form of triglycerides [4].

In the reviewed articles, the "structure-activity" relationship between the widely studied derivatives of betulin was discussed and in vitro, in vivo and ex vivo studies showed that this group of compounds is promising pharmaceutical active substances. It has been found that the anti-tumor activity spectrum mainly depends on the substituents on the C-3 and C-28 carbon atoms in the lupane skeleton, and that

the preservation of the carboxyl group at C-28 of betulinic acid is important [3-6]. In this case, almost all C–3 derivatives showed extremely high cytotoxicity in all cell lines studied. Currently, antiseptic, hepatoprotective, antioxidant, immunomodulatory, anti-inflammatory and wound-healing properties of betulin have been confirmed. In addition, anti-viral activity of betulin is evident in all types of herpes - poliomyelitis, malaria and respiratory diseases. The presence of antifungal activity can serve as a basis for the development of promising drugs for the treatment and prevention of mycoses of hair, nails and skin [3-6].

Taking into account that the chemical composition of the bark of Betula Turkestanica Roth, which grows in our republic, has not been studied, the yield of its extractives in different solvents was comparatively studied. Extractives were extracted from Turkestan white birch bark using three different solvents (hexane, ethyl acetate, and isopropanol) in order of increasing polarity (Table 1).

Table 1

Extractive substances of the bark of Betula turkestanica Roth and their composition

№	The amount of bark, g	Solvent	Amount of extractives, %		Amount of Betulin, %
1	50	isopropanol	13,2	34,2 (20,6*)	46,0 (46,0*)
2	50	ethyl acetate	17,1	30,4 (15,5*)	68,0 (60,0*)
3	50	hexane	15,2	26 (10,5*)	82,0 (90,0*)

***literature information**

The structure of recrystallized betulin from ethyl alcohol was confirmed by IR-spectroscopy and X-ray structural analysis methods. The IR spectrum of betulin showed valence vibrations of hydroxyl groups (3200-3600 cm-1) and C-C bond (1230-1320 cm-1), and deformation vibrations of the -OH group in the 1390 cm-1 region. –CH3 group was observed at 1470 cm-1, C=C bond at 1660 cm-1 and valence vibrations of =CH2 group at 2310-3070 cm-1. Low liquefaction temperature of the obtained betulin (251-252oC) can be explained by the crystalline solvate state formed as a result of recrystallization from ethyl alcohol. Betula Turkestanica Roth bark extracts contained 82% betulin. As the polarity increases, the amount of extractives in hexane, ethylacetate, isopropanol decreases by 26, 30.4, 34.2, and the amount of betulin decreases in the order of 82, 68, 46, respectively.

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