“L.E.V.”/Ekstraktu rupnica/ Ltd.

Organic Baltic Birch sap conc.

Introduction

Baltic Organic Birch Sap conc. is a clear natural ingredient, harvested in Baltic area and manufactured with concentration in 5-6 times. It has a long tradition in application for food and cosmetic purposes in our country. It may be collected in short spring period for 2-3 weeks. One tree gives about 50 L of natural sap. The collection is carried out with a very mild damage of the strunk, which heals quickly and without negative consequences for alive tree.

Replacing water with plant juices and infusions could be a growing trend in near future to further boost product efficacy. Birch sap, for instance, contains vitamin C as well as various phenolic compounds and glycosides, which in previous studies have shown antiradical activity and a great potential as an effective water replacement (Kūka et al. 2013; Mukherjee et al. 2011).

Chemical composition

Active ingredients are fructose, sucrose, organic acids as malic, succinic, citric and phosphorous, magnesium, manganese, zinc and so on.
The chemical composition of birch sap is relatively varied because it is a natural product that depends on season, collecting time, collecting location, etc.

Table 1. Chemical composition of different samples from birch sap concentration process.

Parameter	Initial birch sap	Concentrated birch sap	Permeate
Brix	0.9	5.0	0.0
Sugars, %	0.89	5.01	0.00
Acids, %	0.08	0.41	0.00
pH	5.54	5.60	6.97
Amino acids, mM	0.12	0.59	0.00

The Brix value of birch sap is usually in the range 0.5-1.5. University of Turku has measured the seasonal variation of the sugars in birch sap in Finland (Ref.1). The highest content of dry matter mentioned in the article is 2.0%. The average sugar content of Finnish birch sap (Nord source) is

approx. 1%. Similar values have also reported for other Scandinavian countries, Baltic countries, Russia and China (Ref.2). Thus, uncondensed birch sap has about 0.5 to 2% of sugar content, averaging around 1%. The sugar content depends on collecting time, birch variety, location, and weather. Even though this may seem like a low concentration, it is higher than in many other tree species.
The main organic acid in fresh birch sap is malic acid. The concentration range for malic acid in Organic Baltic Birch sap is 0.02%-0.1%. Fifty-five biologically active compounds were separated from birch sap. Most dominant peak with retention time at 1.49 min contained a very polar fraction of birch sap, including three organic acids, **succinic acid, malic acid** and **citruline (**represented about 6.7% of the total amount),
There are **five amino acids**, and **phenolic compound** metabolite tyrosol 4-sulphate (represented about 32.6 % of the total amount). Overall, nine amino acids were separated from birch sap and represented about 16.8 % of the total amount, including **leucine** (2), **isoleucine** (3), **glutamine**, and **phenylalanine**. It should be noted that organic acids and amino acids separated from the Baltic birch sap sample are widely distributed and described in the birch sap products. It was found that birch sap was not very rich with **phenolic compounds**, but it had **homovanillic acid** (4), **(+)-catechin 3-O-glucose** (6), and **resveratrol 3-O-glucoside** (8). Birch sap containe **betulin** (7) which represented about 2.4% of the total amount and some undidentified **tannins.**

The sap is rich in mineral **micro-** and **macroelements.** Calcium (**Ca**), sodium (**Na**), magnesium (**Mg**), potassium (**K**) and iron (**Fe**) are prevailing elements followed by small amounts of **Mn**, **Zn, Cu, Al** and **Ni** (Zyryanova et al. 2010; Jeong et al. 2013). It is proved that Latvian birch sap contains up to 20% more **glucose** and **fructose** than birch sap produced in Finland (Kūka et al. 2013).

Organic Baltic Birch Sap conc. as an Active ingredient

The effects of birch sap on proliferation are shown in Fig.1. Birch sap slightly stimulates proliferation of dermal fibroblasts during the first 24 h of incubation. 50% birch sap showes the most stimulating activity as cell proliferation increased by 35.48 ± 9.79%. Stimulating activity remained during the 48 h incubation period. In HaCaT keratinocytes stimulation of proliferation is dose dependent, with both highest doses exhibiting the most pronounced effect. Birch sap at 50% stimulates cell proliferation by 41.75 ± 29.70% and at 25% by 46.72 ± 27.40%. In a 48-h incubation period only the highest dose showes stimulatory effect as proliferation rate increased by 34.38 ± 17.13%.

Previous findings suggest that the complex of amino acids, sugars and mineral elements is the reason for promotion of cell growth and proliferation, which serves as a rationale for the inclusion of sap as an ingredient in anti-ageing cosmetic compositions.

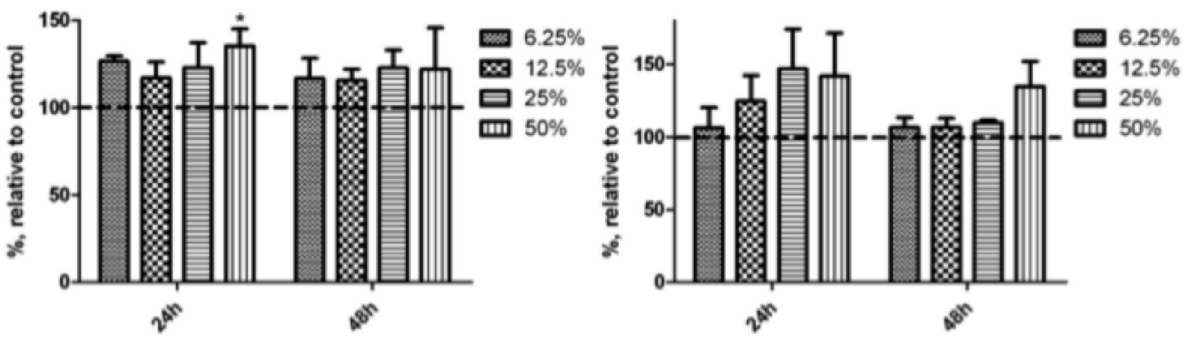

Fig.1

Application

Thanks to the unic constituents content **Baltic Organic Birch sap conc.** has a wide potential for its application in cosmetics. Skin hydration testing have shown the improvement on skin in comparison with demineralised water. 10% version showed an 11% increase in skin hydration, 20% version showed a 38% increase in 1 week application. Good results were revealed conducted an elasticity Cortex test. 10% sap have increased it in 38% and 20% sap – in 44% elasticity modulus, thus promoting wrinkle reduction. SEM testing revealed that birch sap promotes to increase hair shaft diameter. The encrease of hair volume was demonstrated in comparison with demineralised water. The results showed that Birch sap conc. application is extreamly useful for hair care.

Baltic Organic Baltic Birch sap conc. is useful for hair, mascaras, skin care cosmetics as well with its addition in 5-10%.

The findings of the study indicate that birch water has a significant anti-age activity. As confirmed by cell cycle analyses and cell proliferation (growth) analysis, birch water speeds up dermal cell regeneration by 25% compared to control (Fig.2).

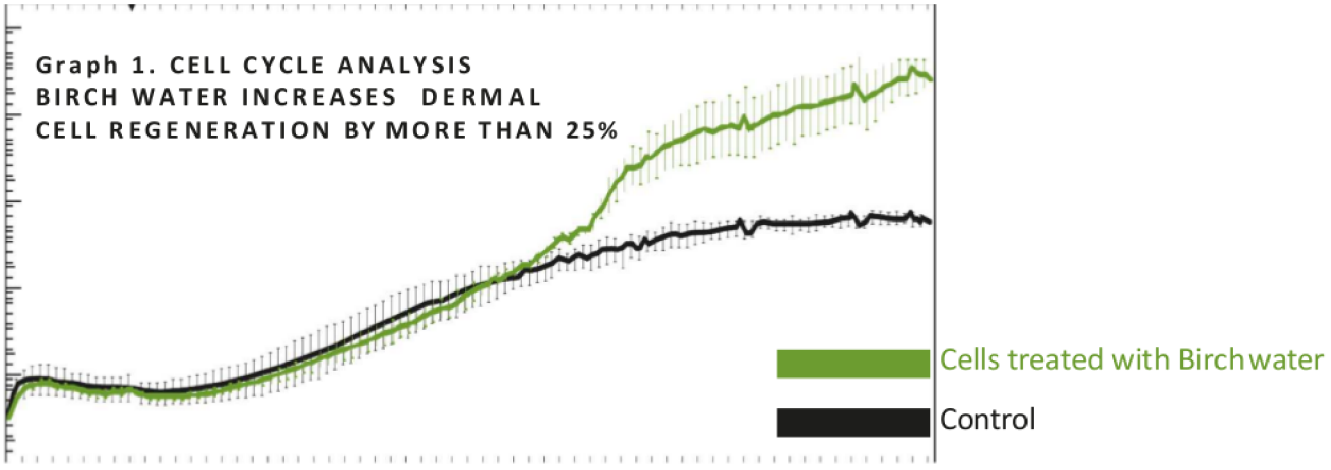

Fig.2

In presence of birch water skin cells show significantly lower accumulation of aging markers, indicating that nutrients present in birch water make skin cells stay functional and healthy for a longer period of time and are able to actively synthesize essential youth proteins such as collagen and elastin.

Another significant finding indicates that birch water has strong antioxidant effect, reducing negative impact of environment such as pollution and UV rays. Study shows that dermal cells previously treated

with birch sap are considerably more resistant to oxidative damage and there is lower accumulation of free radicals (Fig.2). Birch water is a powerful free-radical scavenger, helping to neutralise aggressive oxygen molecules and repairing damage done to skin cell's DNA.

Antioxidant properties of birch water reduce the negative effects of photo-aging, environmental pollution and consequences of inflammation.

This research has been funded with support of MADARA Cosmetics JSC and Pharma and Chemistry Competence Centre of Latvia (Ref.39).

For more information
info@lev-extracts.com

Manufacturer
L.E.V./Ekstraktu rupnica/ Ltd.
Gludas pagasts, Jelgavas novads, Latvia

Baltic Birch sap is suited for Kosher, Vegan, Halal, Organic defined products.

We invite you to enjoy the use of the ingredient in your formulations.

References

1. Kallio H., Ahtonen S., Seasonal variations of the sugars in birch sap, Food Chem., 1987, 25(4), 293–304.
2. Helfferich D., Birch: white gold in the boreal forest, Agroborealis, 2003, 35(2), 4–12.
3. Łuczaj Ł., Bilek M., Stawarczyk K., Sugar content in the sap of birches, hornbeams and maples in southeastern Poland, Cent. Eur. J. Biol., 2014, 9(4), 410-416.
4. Svanberg I., Sõukand R., Łuczaj Ł., Kalle R., Zyryanova O., Dénes A., et al., Uses of tree saps in northern and eastern parts of Europe, Acta Soc. Bot. Pol., 2012, 81(4), 343–357
5. Kallio H., Ahtonen S., Seasonal variations of the acid in birch sap, Food Chem., 1987, 25(4), 285–292.
6. Afaq F., Zaid M.A., Khan N., Dreher M., Mukhtar H. 2009. Protective effect of pomegranate-derived products on UVB-mediated damage in human reconstituted skin. Exp. Dermatol.18: 553–561.
7. Environmental and Experimental Biology (2017) 15: 29–36, DOI: 10.22364/eeb.15.05
Chemical characterization and in vitro evaluation of birch sap and a complex of plant extracts for potential use in cosmetic anti-ageing products Mārtiņš Borodušķis 1 *, Elza Kaktiņa 1 , Ilze Blāķe 1 , Ilva Nakurte 2 , Diana Dzabijeva 2 , Iveta Kusiņa 3 , Santa Mičule 3 , Anna Ramata-Stunda 1
8. Bernstein E.F., Chen Y.Q., Kopp J.B., Fisher L., Brown D.B., Hahn,P.J., Robey F.A., Lakkakorpi J., Uitto J. 1996. Long-term sun exposure alters the collagen of the papillary dermis. Comparison of sun-protected and photoaged skin by northern analysis, immunohistochemical staining, and confocal laser scanning microscopy. J. Am. Acad. Dermatol. 34: 209–218.
9. Bolivar P., Cruz-Paredes C., Hernández L.R., Juárez Z.N., Sánchez-Arreola E., Av-Gay Y., Bach H. 2011. Antimicrobial, anti-inflammatory, antiparasitic, and cytotoxic activities of Galium mexicanum. J. Ethnopharmacol. 137: 141-147.
10. Bosset S., Bonnet-Duquennoy M., Barré P., Chalon A., Lazou K.,Kurfurst R., Bonté F., Schnébert S., Disant F., Le Varlet B., Nicolas J.F. 2003. Decreased expression of keratinocyte beta1 integrins in chronically sun-exposed skin in vivo. British J. Dermatol. 148: 770–778.
11. Brenneisen P., Wenk J., Wlaschek M., Krieg T., Scharffetter-Kochanek K. 2000. Activation of p70 ribosomal protein S6 kinase is an essential step in the DNA damage-dependentCharacterization and evaluation of birch sap and plant extracts for use in cosmetic products signaling pathway responsible for the ultraviolet B-mediated increase in interstitial collagenase (MMP-1) and stromelysin-1 (MMP-3) protein levels in human dermal fibroblasts. J. Biol.Chem. 275: 4336–4344.

12. Calò R., Marabini L. 2014. Protective effect of Vaccinium myrtillus extract against UVA- and UVB-induced damage in a human keratinocyte cell line (HaCaT cells). J. Photochem. Photobiol. B 132: 27–35.
13. Cao C., Wan S., Jiang Q., Amaral A., Lu S., Hu G., Bi Z., Kouttab N., Chu W., Wan Y. 2008. All-trans retinoic acid attenuates ultraviolet radiation-induced down-regulation of aquaporin-3 and water permeability in human keratinocytes. J. Cell. Physiol. 215: 506–516.
14. Chaher N., Krisa S., Delaunay J.C., Bernillon S., Pedrot E., Mérillon J.M., Atmani D., Richard T. 2016. Unusual compounds from Galium mollugo and their inhibitory activities against ROS generation in human fibroblasts. J. Pharm. Biomed. Anal. 117: 79–84.
15. Chen W.C., Liou S.S., Tzeng T.F., Lee S.L., Liu I.M. 2013. Effect of topical application of chlorogenic acid on excision wound healing in rats. Planta Med. 79: 616–621.
16. Duque L., Bravo K., Osorio E. 2017. A holistic anti-aging approach applied in selected cultivated medicinal plants: A view of photoprotection of the skin by different mechanisms. Ind. Crop. Prod. 97: 431–439.
17. El-Domyati M., Attia S., Saleh F., Brown D., Birk D.E., Gasparro F., Ahmad H., Uitto J. 2002. Intrinsic aging vs. photoaging: a comparative histopathological, immunohistochemical, and ultrastructural study of skin. Exp. Dermatol. 11: 398–405.
18. Fisher G.J., Kang S., Varani J., Bata-Csorgo Z., Wan Y., Datta S., Voorhees J.J. 2002. Mechanisms of photoaging and chronological skin aging. Arch. Dermatol. 138: 1462–1470. Gopaul R., Knaggs H.E., Lephart E.D. 2012. Biochemical investigation and gene analysis of equol: A plant and soy- derived isoflavonoid with antiaging and antioxidant properties with potential human skin applications. Biofactors 38: 44-52.
19. Guinot C., Malvy D.J., Ambroisine L., Latreille J., Mauger E., Tenenhaus M., Morizot F., Lopez S., Le Fur I., Tschachler E. 2002. Relative contribution of intrinsic vs extrinsic factors to skin aging as determined by a validated skin age score. Arch. Dermatol. 138: 1454–1460.
20. Guo R., Guo X., Li T., Fu X., Liu R.H. 2017. Comparative assessment of phytochemical profiles, antioxidant and antiproliferative activities of Sea buckthorn (Hippophaë rhamnoides L.) berries. Food. Chem. 221: 997–1003.
21. Hamad I., Erol-Dayi O., Pekmez M., Onay-Ucar E., Arda N. 2007. Free radical scavenging activity and protective effects of Alchemilla vulgaris (L.). J. Biotechnol. 131: 40–41.
22. Herald T.J., Gadgil P., Tilley M. 2012. High-throughput micro plate assays for screening flavonoid content and DPPH-scavenging activity in sorghum bran and flour. J. Sci. Food Agr. 92: 2326–2331.
23. Jeong S.J., Jeong H.S., Woo S.H., Shin C.H. 2013. Consequences of ultrafiltration and ultraviolet on the quality of white birch (Betula platyphylla var. japonica) sap during storage. Aust. J. Crop. Sci. 7: 1072−1077.
24. Kim J., Hwang J.S., Cho Y.K., Han Y., Jeon Y.J., Yang K.H. 2001. Protective effects of (–)-epigallocatechin-3-gallate on UVA- and UVB-induced skin damage. Skin Pharmacol. Appl. Skin Physiol. 14: 11–19.
25. Kligman L.H., Akin F.J., Kligman A.M. 1985. The contributions of UVA and UVB to connective tissue damage in hairless mice. J. Invest. Dermatol. 84: 272-276.
26. Kūka M., Čakste I., Geršebeka E. 2013. Determination of bioactive copounds and mineral substances in Latvian birch and maple saps. Proc. Latv. Acad. Sci. Sect. B 67: 437–441.
27. Lewis K.G., Bercovitch L., Dill S.W., Robinson-Bostom L. 2004. Acquired disorders of elastic tissue: part I. Increased elastic tissue and solar elastotic syndromes. J. Am. Acad. Dermatol. 51: 1–21.
28. Makrantonaki E., Zouboulis C.C. 2007. The skin as a mirror of the aging process in the human organism--state of the art and results of the aging research in the German National Genome Research Network 2 (NGFN-2). Exp. Gerontol. 42: 879–886.

29. Masaki H. 2010. Role of antioxidants in the skin: Anti-aging effects. J. Dermatol. Sci. 58: 85–90.
30.Moore J.O., Wang Y., Stebbins W.G., Gao D., Zhou X., Phelps R., Lebwohl M., Wei H. 2006. Photoprotective effect of isoflavone genistein on ultraviolet B-induced pyrimidine dimer formation and PCNA expression in human reconstituted skin and its implications in dermatology and prevention of cutaneous carcinogenesis. Carcinogenesis 27: 1627–1635.
31. Mukherjee P.K., Maity N., Nema N.K., Sarkar B.K. 2011. Bioactivecompounds from natural resources against skin aging. Phytomedicine 19: 64–73.
32. Nichols J.A., Katiyar S.K. 2010. Skin photoprotection by natural polyphenols: Anti-inflammatory, anti-oxidant and DNA repair mechanisms. Arch. Dermatol. Res. 302: 71.
33. Ozolinčius R., Bareika V., Rubinskienė M., Viškelis P., Mažeika R., Staugaitis G. 2016. Chemical composition of silver birch (Betula pendula Roth.) and downy birch (Betula pubescens Ehrh.) sap. Balt. For. 22: 222–229.
34. Rajendra Prasad N., Karthikeyan A., Karthikeyan S., Reddy B.V. 2011. Inhibitory effect of caffeic acid on cancer cell proliferation by oxidative mechanism in human HT-1080 fibrosarcoma cell line. Mol. Cell. Biochem. 349: 11–19.
35. Rhie G., Shin M.H., Seo J.Y., Choi W.W., Cho K.H., Kim K.H., Park K.C., Eun H.C., Chung J.H. 2001. Aging- and photoaging-dependent changes of enzymic and nonenzymic antioxidants in the epidermis and dermis of human skin in vivo. J. Invest. Dermatol. 117: 1212–1217.
36. Takeda K., Gosiewska A., Peterkofsky B. 1992. Similar, but not identical, modulation of expression of extracellular matrix components during in vitro and in vivo aging of human skin fibroblasts. J. Cell Physiol. 153: 450-459.
37. Trojahn C., Dobos G., Lichterfeld A., Blume-Peytavi U., Kottner J. 2015. Characterizing facial skin ageing in humans: disentangling extrinsic from intrinsic biological phenomena. Biomed Res. Int. 2015: 318586.
38. Varani J., Dame M.K., Rittie L., Fligiel S.E., Kang S., Fisher G.J., Voorhees J.J. 2006. Decreased collagen production in chronologically aged skin: roles of age-dependent alteration in fibroblast function and defective mechanical stimulation.
39. Borodušķis, E. Kaktiņa, I. Blāķe, I. Nakurte, D. Dzabijeva, I. Kusiņa, S. Mičule, A. Ramata-Stunda
Chemical characterization and in vitro evaluation of birch sap and a complex of plant extracts for potential use in cosmetic anti-ageing products. Environmental and Experimental Biology (2017) 15: 29–36, DOI: 10.22364/eeb.15.05
39. Vayalil P.K., Mittal A., Hara Y., Elmets C.A., Katiyar S.K. 2004. Green tea polyphenols prevent ultraviolet light-induced oxidative damage and matrix metalloproteinases expression in mouse skin. J. Invest. Dermatol. 122: 1480–1487.
40. Weiss J.S., Ellis C.N., Headington J.T., Voorhees J.J. 1988b. Topical tretinoin in the treatment of aging skin. J. Am. Acad. Dermatol.19: 169–175.
41. Yaar M., Gilchrest B.A. 2001. Ageing and photoageing of keratinocytes and melanocytes. Clin. Exp. Dermatol. 26: 583–591.
42. Zouboulis C.C, Makrantonaki E. 2011. Clinical aspects and molecular diagnostics of skin aging. Clin. Dermatol. 29: 3–14.
43. Zyryanova O.A., Terazawa M., Takayoshi K., Zyryanov V.I. 2010. White birch trees as resource species of Russia: their distribution, ecophysiological features, multiple utilizations. Eur. J. For. Sci. 13: 25–40.