**Name of the plant**
Picea abies

**Part of the plant used**
Knots wood

**Formula**
\[ C_{20}H_{22}O_7 \text{ (hydroxymatairesinol)} + C_{18}H_{33}KO_2 \text{ (hydroxymatairesinol-D3)-potassium acetate adduct} \]

**IUPAC Name**
4-[Hydroxy(4-hydroxy-3-methoxyphenyl)methyl]-3-(4-hydroxy-3-methoxybenzyl)-dihydrofuran-2(3H)-one - potassium acetate adduct

**Molecular weight**
374.39 g/mol (hydroxymatairesinol) + 98.14 g/mol (AcOK)

**Appearance**
Off-white crystalline powder

**Solubility**
Soluble in methanol

**Identification**
IR, UV

**Assay**
Hydroxymatairesinol + allo-isomer-potassium acetate

**NLT 90 %**

**Related substances**
Matairesinol

**NMT 7 %**

**Water content**
NMT 10 %

**Heavy metals**
NMT 20 ppm

**Microbiology**
Complies with EP

**Storage**
Preserve in tight container, protected from light, heat and humidity.

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**Technical Description**

**Structural Formula**

\[
\text{[AcOK]}^+
\]

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**Bibliographic References**


Lignans are a group of phytonutrients readily distributed in the plant kingdom. Their importance in health maintenance has been underlined by an increasingly large pool of scientific knowledge and epidemiological data, which has identified them in a wide variety of foods such as unrefined grain products, seeds, beans, flax, berries, fruits, and vegetables [1]. Unlike our ancestors’ diets, today’s Western diet does not include much in terms of lignan-containing foods so the amount of lignans in our diet is quite limited. Many researchers suggest that the decreased intake of foods containing lignans precursors has left women without the ability to metabolize estrogen naturally and, for this reason, supplementation with a natural concentrated source is recommended. Norwegian spruce lignans have been found to be rich in lignans and, in particular, 7-hydroxymatairesinol, also called HMR [2]. The Norwegian spruce extract is a new generation of lignan complex that provides a highly bioavailable supplement and a more digestible alternative to natural sources. It also carries out the estrogen-like activity that plays an important role in their reported proflolic action against cardiovascular disease and tumor.

Lignans

HMRlignan™ is derived from Norway Spruce Lignans. The Norway spruce (Picea abies), which belongs to the Pinaceae family, is a large evergreen conifer tree growing to a height of 35-40 m (115-130 ft) and having a trunk diameter of 1.5 m. The species of spruce is native to Europe and plentiful in Nordic countries such as Finland, where it is used extensively in forestry for timber and paper quality.

Common Applications

Lignan intake increases serum enterolactones, which is correlated with a decrease in the risk of coronary heart disease and cardiovascular disease in middle-aged people. Like HMR, lignans help to control the severity and frequency of menopausal symptoms and their presence in the blood and urine of women has been correlated with a reduced risk of related chronic diseases [3]. A high intake of lignans in postmenopausal women leads to a favourable metabolic cardiovascular risk profile with low breast cancer rates. In fact, breast cancer is a hormone-regulated disease controlled by estrogens via a complicated series of pathways. Breast health also in an emerging area where lignans are being shown to play a positive role. Here too, promiscuous effects are known to play an important role in bone maintenance by regulating bone reabsorption. With regard to human health, the amount of evidence highlighting the benefits of lignans in the maintenance of prostate wellbeing is growing and suggests that enterolactone may have a direct inhibitory effect on cancer cell growth and signaling.

Clinical Evidence

Both epidemiological and clinical studies support the efficacy of dietary lignans in preventing various estrogen-related diseases/symptoms such as breast and prostate cancer, menopausal symptoms, cardiovascular diseases, and osteoporosis.

Menopause symptoms

Lignans help to control the menopause by acting on several symptoms. In a 2002 Canadian study lignans were shown to improve midlife menopausal symptoms and to lower glucose and insulin levels [3]. A significant reduction in the frequency of hot flushes was observed in two Australian studies [7,8] involving postmenopausal women (average age 50, range 30-70) years) suffering at least 14 hot flushes per week. Menopause symptom scores as well as hot flushes were significantly decreased in the groups taking lignan supplementation.

A recent study conducted by Dutch researchers has evaluated the influence of dietary phytoestrogens intake on cognitive function showing that women consuming higher levels of lignans performed better in the Mini-Mental State Examination [9].

Bone health

Several studies have shown a link between lignan intake and bone reabsorption reporting a relationship between urinary lignans excretion and bone mineral density (BMD) in postmenopausal women. Reported results showed that, in osteoporotic patients, urinary enterolactone was lower than average and that higher BMD was correlated with a higher level of urinary enterolactones [10].

Cardiovascular disease

The Kuopio Ischaemic Heart Disease Risk Factor Study examined the dietary intake of lignans and serum enterolactone levels with a reduction in the risk of coronary heart disease and cardiovascular disease in middle-aged Finns [10,11]. In a more recent study, a novel lignan source was examined in a mouse model to assess the influence of dietary phytoestrogens intake on cognitive function showing that women consuming higher levels of lignans performed better in the Mini-Mental State Examination [9].

Toxicity and Safety

As this is a novel lignan source, the researchers conducted extensive safety testing in accordance with the rules of pharmaceutical GCP (Good Clinical Practice).

In a 13-week toxicity study high systemic exposure to HMRlignan™ was tested by dose-related increases in the total (unconjugated and unconjugated plasma concentration of 7-HMR and the metabolites enterolactone, 7-hydroxyenterolactone and matairesinol. Enterolactone is the main metabolite. HMRlignan™ exposure did not significantly affect clinical, pathological, biochemical, neurophysiological, or motor activity. The observed adverse effects of HMRlignan™ were at 0.125 in food, corresponding to 100 mg/kg body weight. In May 2004, Food Dietary Ingredients’ FDA clearance from the FDA was obtained for the ingredient.