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KALEVI PIHLAJA

BIOLOGICALLY ACTIVE SUBSTANCES IN PEAT — IS IT POSSIBLE TO CHARACTERIZE THEM AND THEIR MODES OF ACTION AT THE MOLECULAR LEVEL?

TURPEEN BIOLOGISESTI AKTIIVISISTA AINEISTA JA NIIDEN LUONTEESTA

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A short review on biologically active substances in peat and their characterization is given. There is a clear need for further multidisciplinary research into use of peat as a chemical raw material. The material is based on a lecture presented at DGMT-symposium "Operating Mechanisms of Peat Therapy" in Bad Alexandersbad, FRG, 1985.

Key words: peat therapy, biologically active substances, mode of action at the molecular level

Kalevi Pihlaja, Department of Chemistry, University of Turku, SF-20500 Turku, Finland

Peat consists of many biologically and physiologically active substances (eg Eichelsdörfer 1980, Fuchsman 1980, Pihlaja et al. 1982 & 1983, Tolpa et al. 1972), the influences of which have been studied in horticulture, agriculture and for medical purposes. Although fairly much attention has been paid to their modes of action and separation, detailed knowledge is still rather limited, at least at the molecular level.

Peatlands are potential sources of raw-materials for different chemical products including waxes, resins, sterols, humic and fulvic acids, and carbohydrates as well as for peat therapy (e.g. Fuchsman 1980, Pihlaja et al. 1982 & 1983, Tolpa et al. 1972). Biologically and physiologically active components in peat can be roughly divided into medically (Adamek 1976, Fuchsman 1980, Gornick et al. 1972, Lishtvan et al. 1981, Pihlaja & Karunen 1982, Solovieva et al. 1980, Weber & Plötner 1976) and horticulturally (Fuchsman 1980, Pihlaja et al. 1982 & 1983, Puustjärvi 1977) beneficial factors. The versatility of peat organic compounds offers, in principle, many possibilities to utilize them for pharmaceutical purposes. These have been reviewed earlier by, for example, Fuchsman 1980, Pihlaja & Karunen 1982, and Tolpa et al. 1972. In general, biologically active components in peat may even inhibit or mask each other's influence so that no net activity is observed (Maugh II 1981, Ries et al. 1977, Tolpa et al. 1972).

Especially much attention on the medically and pharmaceutically active components in peat has been paid by researchers in Poland and Soviet Union. For instance, the Soviet Union has developed the *Torfot*-preparation from low-moor sedge or cottongrass-sedge peat (Fuchsman 1980), which has been claimed to be a rather effective medication in many branches of medicine (Solovieva ym. 1980). Another preparation, *Torfenal*, can be obtained by extraction of peat waxes and resins (Lishtvan 1981) and it has been stated to cure psoriasis and neorodematitis. In the former disease, volatile phenols and amines and in the latter, different sterols, phenolic carboxylic acids and compounds with estrogenic activity are among the active components.

The curative effects of peat baths are also well known (Burkacka-Laukajtys et al. 1976, Eichelsdörfer 1980, Korhonen 1986, Lishtvan 1981, Stecker & Gyarmati 1980, Weber & Plötner 1976). Actually the technical characteristics of balneological peat are fairly well known (Eichelsdörfer 1980), although a detailed chemical definition at the molecular level for clinical purposes has not yet been developed (Olechnowicz-Stepien & Rzadkowska - Bodalska 1976, Pihlaja & Karunen 1982, Sinclair 1981, Stecker & Gyarmati 1980). The same is also true of the biologically active components in general (Pihlaja et al. 1981, 1982 & 1983).

In principle it should be possible to improve the situation with the aid of the latest research methods and modern instrumentation. Intensive work and — at least partly — trial and error type approaches are needed to eliminate and limit various alternatives.

In the context of our recent studies on chemical mapping of peatlands (Pihlaja et al. 1983), biologically active substances in peat (Pihlaja et al. 1981, 1982 & 1983) and environmental impacts of peat production (Pihlaja & Peuravuori 1986) it has become particularly clear that a thorough clarification of, for example, the operating mechanisms of peat therapy at the molecular level can be best — if at all — solved by an extensive interdisciplinary collaboration including chemists, biologists, soil geologists, physicians and other necessary experts.

The crucial question would then be sufficient funding in order to organize a versatile research unit for developing chemical refining of peatlands and separating and testing biologically and physiologically active compounds in them.

There should be no doubt that peat as a chemical raw material can be regarded at least as valuable as its fuel value although investments, at least in Finland, have favoured the latter use. Recently the situation has somewhat improved mainly because (i) the basic research necessary for the chemical mapping of peatlands has been initiated, and (ii) funding has become more available for research other than energy as the urgency of the latter has greatly diminished. Different strategies for chemical characterization of peat and for testing its biologically active components have been described elsewhere (Pihlaja et al. 1982 ja 1983).

Independent of the short-sightedness of decision makers and the diversity of (organic) peat constituents, a break-through in peat research to the molecular level of characterising active compounds (biologically, physiologically and medically), as well as their modes of action would profit peat research as a whole and indirectly also give a better understanding of humic substances and their role in nature. By combining both national and international expertise it should be possible to overcome many of the problems and to make new and important observations and findings. At least it is worth trying.

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TIIVISTELMÄ

TURPEEN BIOLOGISESTI AKTIIVISISTA AINEISTA JA NIIDEN LUONTEESTA

Turve sisältää monia biologisesti ja fysiologisesti aktiivisia aineita, joiden vaikutusta on tutkittu sekä puutarhanhoitoa, maanviljelystä että lääketieteellisiä tarkoitusperiä silmällä pitäen. Kaikesta huolimatta näistä tekijöistä ja niiden toimintaperiaatteista molekyylitasolla tiedetään suhteellisen vähän.

Joka tapauksessa soita voidaan pitää käyttökelpoisina raaka-ainelähteinä sekä turveterapiaa että esim. vahojen, hartsien, sterolien, humus- ja fulvohappojen ja hiilihydraattien tuotantoa ajatellen. Mm. steroidit, triterpenoidit ja humus- ja fulvohapot kuuluvat niihin turpeen komponentteihin, jotka estävät esimerkiksi bakteerien ja virusten kasvua. Turve ja sammaleet omaavat myös antibioottisia ominaisuuksia.

Vaikkakaan aktiivisilla yhdisteillä ei välttämättä ole samoja biologisia ja fysiologisia vaikutuksia luonnollisesta ympäristöstään eristettyinä, nykyisillä menetelmillä ja laitteilla pitäisi molekyylitason saavuttamisen ja yksityiskohtaisten toimintamallien imitoinnin olla mahdollista ainakin joissakin tapauksissa. Tämä edellyttäisi välttämättä huolellista suunnittelua ja tehokasta tieteidenvälistä yhteistyötä.

Pitkällä tähtäyksellä turpeen biologisesti aktiivisten komponenttien ja niiden toimintamallien tarkempi tuntemus hyödyttäisi sekä turvetutkimusta yleensä että erityisesti turveterapiaa.

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