Research, quality guidelines and use of balneological peat in Finland

Riitta Korhonen

Geological Survey of Finland, P.O. Box 96, FI-02151 Espoo, Finland
Phone: +358 20 550 2390, Mobile: +358 40 524 2486, Fax: +358 20 550 12, e-mail: Riitta.korhonen@gtk.fi

Summary

Research has been carried out on balneological peat in Finland for nearly twenty years. The purpose of the research has been to determine the quality criteria for a good balneological peat and also to develop new types of peat therapy. The qualities of peat samples from 23 mires were tested for this purpose and some new types of peat therapy were developed. The results of researchers and their practical experiences have testified that the best kind of therapy peat is very well humified with a high content of humic acids. The heat retention capacity should also be good. The results demonstrate that a high degree of humification correlates with high content of humic acids. The conclusion of the research and recommendation for good balneological peat is that the degree of the humification should be H7-H8 on the von Post scale and the content of humic acids should be at least 20 % of dry weight. Both *Sphagnum* and *Carex* peat types are suitable for balneological use, as there were no significant differences in quality results between the two peat types. Only pH values differed between *Carex* and *Sphagnum* peat.

Key index words: balneology, humification, humic acids, mire, peat, peat type

Introduction

Peat balneology has a long history in Central Europe. In Finland peat therapy began in the early 1990s. Some new types of peat therapy have been developed and the use of peat in connection with the Finnish sauna has become especially popular. Several training courses for producers and users of therapeutic peat and peat therapists are widely available in the country. Moreover, a balneological and therapeutic peat section has been formed within the Association of Finnish Peat Industries to supervise the use of therapeutic peat in Finland. To support its work, it has been decided that quality criteria for balneological and therapeutic peat should be developed, aiming at uniformity with those of Central Europe. Accordingly, the work of the balneological peat classification team of the VI Commission of the International Peat Society (IPS) serves as a guide.

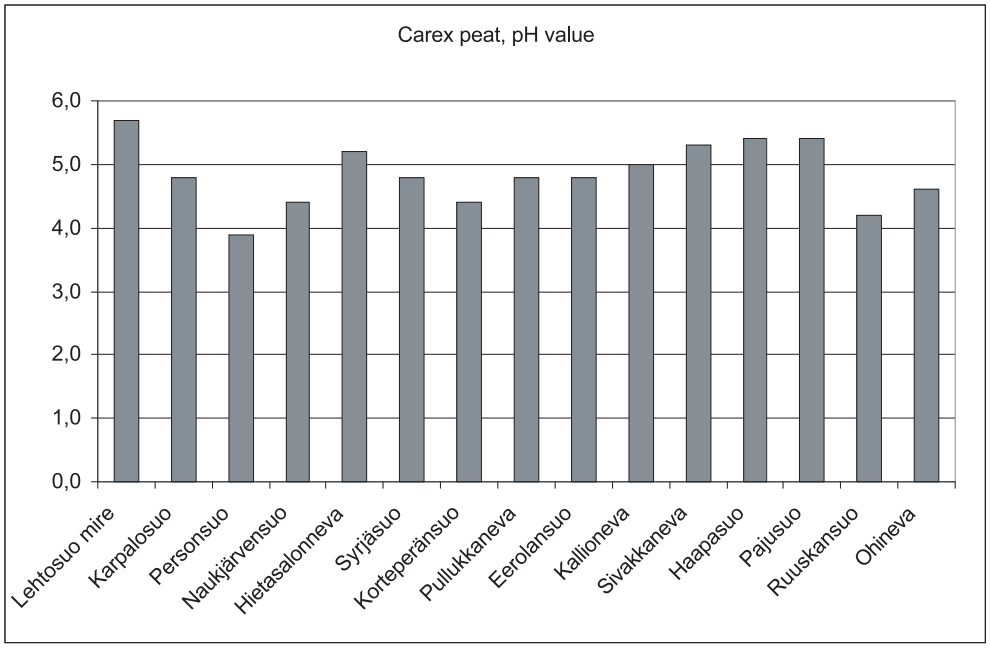
Nowadays, peat baths are available at Rokua spa in the municipality of Utajärvi in Northern Finland, at Salon Siniristi in town of Seinäjoki and Reinos cottage in the town of Kurikka both in Western Finland. The cosmetic use of peat in particular is becoming increasingly common, in beauty parlours as well as at home. The use of peat as a facial or body mask in the sauna has also spread throughout the country.

Materials and methods

The determination of the quality of good balneological peat is based on geological, physical, and chemical as well as microbiological assessment. First, field studies into the origins and development of the mire to be investigated are carried out, establishing the mire site type, peat types, degree of peat decomposition, peat deposit thickness, basal soil types and hydrological conditions. When a peat deposit has been indentified that is thick enough (50 cm) and that has a degree of humification of at least H6 on the von Post scale (H1-H10), the peat is sampled for more detailed analysis in the laboratory.

Peat samples were taken with a volumetric corer to establish the physical-chemical characteristics and to determine the concentrations of inorganic cations. At each study point, a peat sample was also taken to test the heat-retention capacity.

In the laboratory of the Geological Survey of Finland (GSF), the samples were tested to establish the pH value, ash content (at dry weight, 815+/°C) and sulphur content at dry weight with an isothermal calorimeter (Leco SC-39). The water content was determined by drying the peat at 105°C until it reached a constant weight. Additionally, the amount of dry matter in the peat was calculated as kilograms per bog cubic metre. The heat retention capacity was tested with a mixture of peat and water (2 litres) warmed to the temperature of a peat bath (+41°C). The cooling of this mixture was monitored for one hour and compared with the heat retention capacity of water. The chemical characterisation was conducted with a method developed by Peuravuori and Pihlaja at the University of Turku (1988) to establish the yield of extract, the amount of wax and the concentrations of humic acids, fulvic acids, humines, pectins, cellulose and hemicellulose. The contents of the inorganic cations (Al, Ba, Ca, Co, Cr, Cu, Fe, K, La, Mg, Mn, Na, Ni, P, Pb, Si, Sr, Ti, V and Zn) were determined by inductively coupled plasma atomic emission spectrometry (ICP-AES) in the GSF laboratory.



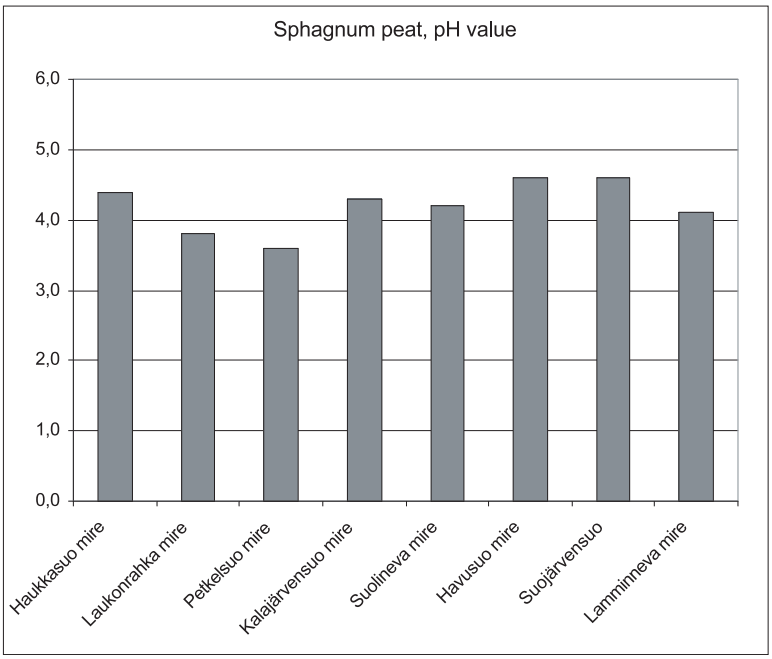


Figure 1. The average pH values in *Sphagnum* and *Carex* peat (n = 105)

Some results of geological-balneological investigations from 23 different mires in Finland are described here. The objective of these investigations has been to establish the physical-chemical properties of Finnish peat in mires selected from areas of differing mire complex type. One of the objectives was also to explore the potential differences between ombrogenic *Sphagnum* peat (S) and minerogenic *Carex* peat (C). The investigated bogs represented plateau, concentric, and eccentric bogs, as well as some aapa mires. Physical characteristics were examined from 238 samples and chemical characteristics from 105 samples with inorganic cation concentrations being determined for 95 samples.

Results

The average degree of decomposition (humification, H) of peat samples was H7 on the von Post scale (H1 - H10) and the average pH value was 4.4. The water content was 88% by the wet weight; ash content was 4.3% and sulphur content 0.23% by dry weight. The samples from ombrogenic bogs had a lower pH value than those from minerogenic mires (Fig. 2).

The heat retention capacities of the different peat species were tested by cooling water-peat mixtures to simulate a peat bath (Fig. 3). The temperature of the peat mixtures from 17 mires decreased by less than 1°C in 20 minutes. This time is the usual treatment period time in peat therapy, during which the water cooled by an average of 3.5°C.

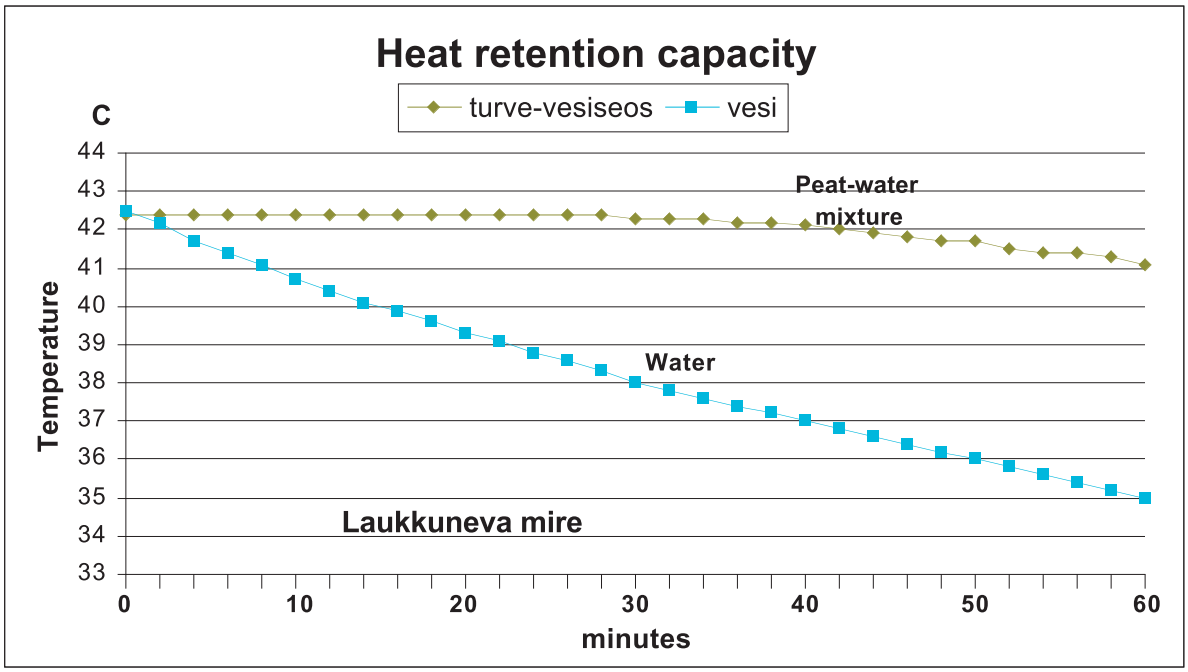


Figure 2. An example of the heat retention capacity of a peat sample.

The results of chemical characterization were compared with the degree of humification of the peat types. To test the correlation between the humic acid content and the degree of humification, 75 samples were divided into three classes: *Sphagnum* peat (S, n = 20), *Carex* peat (C, n = 12) and combinations of these (SC and CS peat, n = 43). There was a clear positive correlation between the humic acid content and the degree of humification (Fig. 4). However, the correlation with fulvic acids, hemicellulose, cellulose and pectins was negative.

The average humic acid content of *Sphagnum* peat was 24.8 % by dry weight and for *Carex* peat it was 26.8%. On average fulvic acid comprised 9.6% of both *Sphagnum* and *Carex* peat. The average hemicellulose content of *Sphagnum* and *Carex* pea, respectively, was 17% and 11.8%, while the respective figures for the average cellulose content were 11.4% and 11.8%. The average proportion of pectins in *Sphagnum* peat was 5.9% by dry weight while for *Carex* peat it was 2.5%. The humin content is a calculated value for the non-hydrolysable matter of peat, also including other non-hydrolysable particles such as lignin. The average humin content was 29.9% in *Sphagnum* peat and 35.1% in *Carex* peat (Fig. 5)

Quality guidelines for balneological peat

Good balneological and therapeutic peat is highly decomposed (preferably H8), homogenised, natural, hygienically produced and packaged. The humic acid content should exceed 20% by dry weight; the ash content should be less than 15% by dry weight, the sulphur content less than 0.3% by dry weight, and the water content more than 85% by wet weight. The peat should not contain harmful bacteria or heavy metals.

Balneological and therapeutic peat packages should bear a product description with the peat producers' contact information, packaging date, information on the storage of the product, the best before date, the most relevant study results, the name of the investigator, and the research institute. It is recommended that (at a minimum) the following laboratory study results should be given: type of

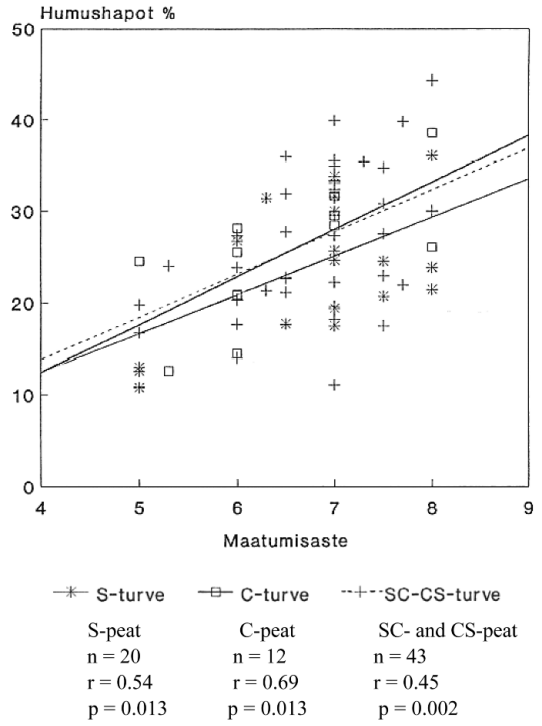
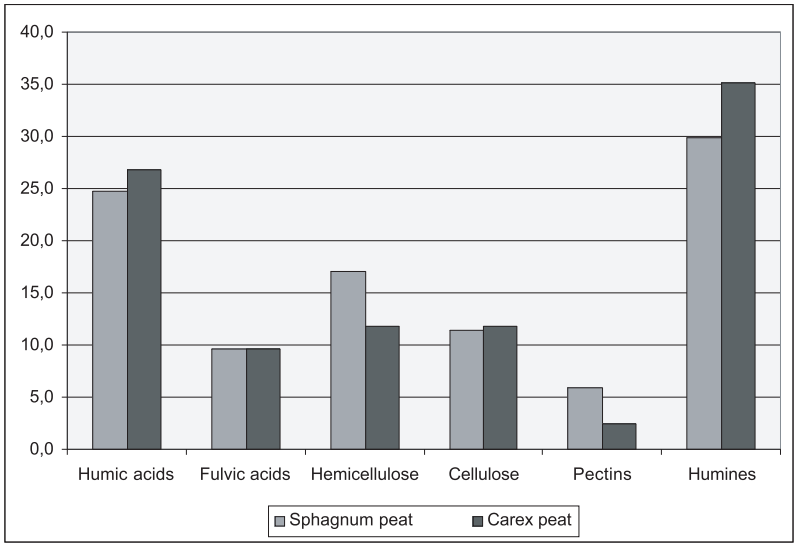


Figure 3. The correlation between the humic acid content (humushapot %) and the degree of humification (maatumisaste) of peat samples (n = 75) S = *Sphagnum* peat, C = *Carex* peat.



	Sphagnum peat	*Carex* peat	Difference
Humic acids	24.8	26.8	2.0
Fulvic acids	9.6	9.6	0.0
Hemicellulose	17.0	11.8	5.2
Cellulose	11.4	11.8	0.4
Pectins	5.9	2.5	3.4
Humins (et cetera)	29.9	35.1	5.2

Figure 4. The average organic matter contents of peat samples (% by dry weight, n=105)

peat, degree of decomposition, ash content, pH, content of humic and fulvic acids, pectins, hemicellulose, cellulose, and humine, and possibly also the amount of bitumen. In addition, element characterisation and microbiological studies should be mentioned. Contra-indications must be given. The peat producer is responsible for the peat quality. For quality assurance purposes it is necessary to inspect the properties of packaged peat at regular intervals.

Conclusions

This study revealed that well-humified *Sphagnum* and *Carex* peats from different mires in Finland had quite similar physical and chemical properties. Almost all peat types had a good heat-retention capacity, although some *Sphagnum* peats were slightly better than *Carex* peat. The average organic matter content was similar for both peat types, but could vary considerably between samples. The average content of humic acids was 2% higher in *Carex* peat than in *Sphagnum* peat while the fulvic acid contents of both peat types were exactly the same. For *Sphagnum* peat the yields of hemicellulose and pectins, respectively, were about 5.2% and 3.4% higher than for *Carex* peat. The contents of inorganic cations were very low and mainly reflected the variations in the ash content. No harmful bacteria or heavy metals were detected.

The degree of humification and the humic acid content are the most important parameters for balneological peat, the minimum degree of humification and the average amount of humic acids should be at least H6 (von Post scale) and over 20% by dry weight, respectively. However, for the very best therapeutic peat a degree of humification of H8 could be recommended.

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