

Preface

Utilization of industrial wastes has always been a major socio-economic function of industrial countries over the world. The increasing amounts of waste in landfills have forced countries to shift from landfills to integrated waste management.

In Estonia the advancement of sustainable waste management is supported by the *Act on Sustainable Development* (1997), in which one of the main targets is to increase recycling of industrial wastes to 50% by the year 2010.

Energy production is one of the most wasteful sectors in Estonia and both energy production and consumption account for the bulk of the air pollution in the country. Electricity generation is mainly based on oil shale; it made up 90% of all fuels used in 2001 and generated 83.3% of the total waste volume in Estonia. It is clear that oil shale mining and processing must be based on principles such as economically expedient and ecologically acceptable utilization technology, environmental protection, and conditions for maintaining agriculture and forestry. As the wastes emitted from oil shale mining and processing contain large amounts of solid compounds rich in several elements that are vitally important nutrients for plant growth, the use of oil shale ash in forestry or agriculture is worthy of detailed scientific research.

Another major producer of industrial wastes in Estonia is the cement plant in Kunda. In 2003, the total amount of all kinds of wastes from this plant amounted to 310 000 tonnes. The production process generated 85 900 tonnes of cement kiln dust out of which about 55 000 tonnes was used for liming fields and 30 000 tonnes was used for the preparation of a filling material used in road construction (*Environmental Review*, No. 13, Kunda, 2004). It has been observed that the liming of fields with cement kiln dust increases yields of agricultural crops. So far cement kiln dust has not been used for liming forests, although scientific research has shown that application of kiln dust raises the nutrition value of soils and may increase the productivity of trees.

In recent years biofuels have become increasingly important worldwide as a present and future alternative to fossil fuels that are cheaper and easier to handle. Due to the increased use of energy wood fuels, the amounts of wood ash originating from the forest are continuously growing, making the problem of ecological and biological effects of wood ash recycling one of the important problems in environmental research.

From the total fuels used in Estonia in 1992 biofuels made up only 6–7%; however, their proportion has been increasing from year to year. While in 1990 wood was used in the production of primary energy to produce 7885 TJ, then by the year 2001 the use of fuelwood had increased almost three times – to 20 617 TJ (*Statistical Yearbook of Estonia*, 2002. Statistical Office of Estonia). The potential negative impact on the forest ecosystem due to the increased utilization of wood-based biomass for energy needs to be mitigated. Possibilities of using ashes in various branches of economy have been rather widely studied worldwide in recent years. One of the main objectives has been investigation of the ecological and biological effects of wood ash recycling in forests. Estonian scientists have paid attention mainly to reviewing and improving the present knowledge on the effects of wood ash application to forest soil, effects on tree growth and production, physiology, nutrient availability, etc.

In the course of treating wastewaters quite large amounts of sludge are produced. Problems concerning the recycling of this material are topical all over the world. The amounts of wastewaters have been increasing from year to year and in order to reduce dumping in landfills, forest scientists have set elucidation of possibilities of using sludge in forestry as one of their research objectives because sludge comprises numerous macro- and microelements necessary for plants. Studies of possibilities of using sludge for forest fertilization have only been started in Estonia and preliminary results in this field have shown some positive effects.

The present issue of the *Proceedings of the Estonian Academy of Sciences* summarizes the results of studies of Estonian scientists, which will replenish our knowledge about the influence of industrial wastes on increment, biomass, mineral nutrition, and physiological state of forest stands. The findings will allow making conclusions about possible use of industrial wastes as fertilizers and for regulating the acidity of soils, promoting matter cycling in stands and improving wood quality.

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