ABSTRACT

SUWAMAS recommends the most effective sustainable waste management strategy taking in consideration the integrated product policy approach and European waste management strategic drivers. *SUWAMAS* is designed to minimise unsustainable production and consumption patterns through the life cycle of the product system. The product system consists of recovery and disposal waste management operations such as mechanical, biological, mechanical-biological, incineration and landfill. Every waste management operation is modelled according to its installed choice of technology, operational conditions and technical requirements.

Over the last years, economic growth has resulted in an unsustainable consumption of scarce natural resources and consequently the generation of greater volumes of waste. Consequently, decision makers must develop effective strategies that ensure the integration of environmental protection, economic growth and social cohesion during every stage of the waste life cycle in the context of sustainable development. Unfortunately, they do not count with an assessment tool that is able to recognise the multidimensionality of sustainability.

SUWAMAS was developed to provide decision makers with a decision-aiding tool that recognises the multidimensionality of sustainability. This new approach seeks the development of waste management strategies that promote economic growth and social cohesion without impairing environmental quality. *SUWAMAS* recommends the most effective sustainable waste management strategy taking in consideration the integrated product policy approach and European waste management strategic drivers. *SUWAMAS* is designed to minimise unsustainable production and consumption patterns through the life cycle of the product system. The product system consists of recovery and disposal waste management operations such as mechanical, biological, mechanical-biological, incineration and landfill. Every waste management operation is modelled according to its installed choice of technology, operational conditions and technical requirements.

Technically, *SUWAMAS* is an integer non-linear mathematical programming model. This model is written in a Lingo environment as a key solving methodology. *SUWAMAS* finds the most effective sustainable waste management strategy by means of minimising a weighted product objective function, which is restricted to defined system constraints. Both the objective function and the system constraints simulate the inter-relation of environmental, economical, social and logistical issues within the system. Every sustainable issue is integrated in *SUWAMAS* with a specific assessment tools such as life cycle assessment, cost benefit analysis, multicriteria decision analysis and multi-commodity flow distribution. As a result, *SUWAMAS* ensures that the proposed sustainable waste management strategy is not only environmentally effective, economically affordable and socially acceptable, but also logistically optimised. Firstly, the environmental effectiveness of the strategy is ensured by minimising the generation of direct and indirect environmental impacts through the entire life cycle of the product system. The life cycle inventory of the product system follows both waste-specific and process-specific models. Similarly, the economically affordability of the strategy is achieved by minimising the net social cost of the system as defined by the objective function. The net social cost function integrates the gross private costs, the environmental costs and the social savings costs derived from the recovery of energy and resources through the complete life cycle of the product system. Social acceptability is reached with the integration of public preferences through effective public participation in the decision making process. The system is logistically optimised by means of determining the optimal flow distribution of primary and secondary waste. This waste flow distribution

considers the number and location of the waste management operations. As a result, it provides the shortest disposal routes between generation and treatment sources. Finally, *SUWAMAS* is a reliable and robust assessment tool, which is ideal for the development of sustainable concepts or strategies required by the waste management sector.