Recycling of Absorbent Hygiene Products (AHPs) waste

Innovation concept

The innovative idea we are proposing is focused on the improvement of the disposal and processing of Absorbent Hygiene Products (AHPs, i.e. baby diapers, feminine pads and adult incontinence products) waste, with regards specifically to the ecological and economic aspects, but which brings substantial benefits also on other areas of improvement (e.g. purchasing and use of incontinence products, well-being of users).

Thanks to a breakthrough technology developed and patented by Fater SpA, a joint venture set up by P&G and the Italian Pharmaceutical Angelini Group, a waste which has been considered "non-recyclable" until very recently, i.e. the waste deriving from Absorbent Hygiene Products can be now recycled. This is a crucial step in offering consumers superior performing products whilst being able to introduce true circular economy solutions to this category.

The system, which today can benefit from the first industrial facility operating in the Province of Treviso at 10,000 t/y capacity, allows to process and sterilize AHP waste separately collected, recovering, with purity percentages above 95%, the valuable materials it contains: polyolefin plastics, cellulose and superabsorbent polymers (SAP). These new secondary raw materials are of high quality and can be used in many new applications. This technology is able to recycle virtually 100% of the used product. One tonne of AHP waste can yield, after the separation of human waste, around 150 kg of cellulose, 75 kg of mixed plastic, and 75 kg of superabsorbent polymer that can be used in new products and processes, giving new life to used diapers.

Fater's recycling process can be divided in four main phases:

1. Feeding: this section of the plant consists of the reception of AHP waste and storing within an air controlled receiving bay, before being conveyed to the central processing unit.
2. Sterilization: this is the core phase of the process, where AHP wastes are loaded in the autoclave, a horizontal cylindrical vessel, which is heated by means of a jacket of saturated "no-contact" steam. The injection of another stream of "contact" steam, together with a particular profile of temperature, vacuum and pressure, provides the necessary sterilization of the AHP waste, which is continuously mixed by the rotation. The sterilization process is certified according to UNI EN ISO 17665, the same used for validating the sterilization of surgical medical devices
3. Drying: the sterilized material coming out from the autoclave is shredded and loaded into a drying system, where its moisture content is significantly reduced.
4. Sorting: the dried material is then mechanically treated, passing through a series of gravimetric separators and optical sorters (NIR-sensors), for the recovery of cellulose fibre, plastic and superabsorbent polymer.

None of the phases entails human contact with AHP waste.

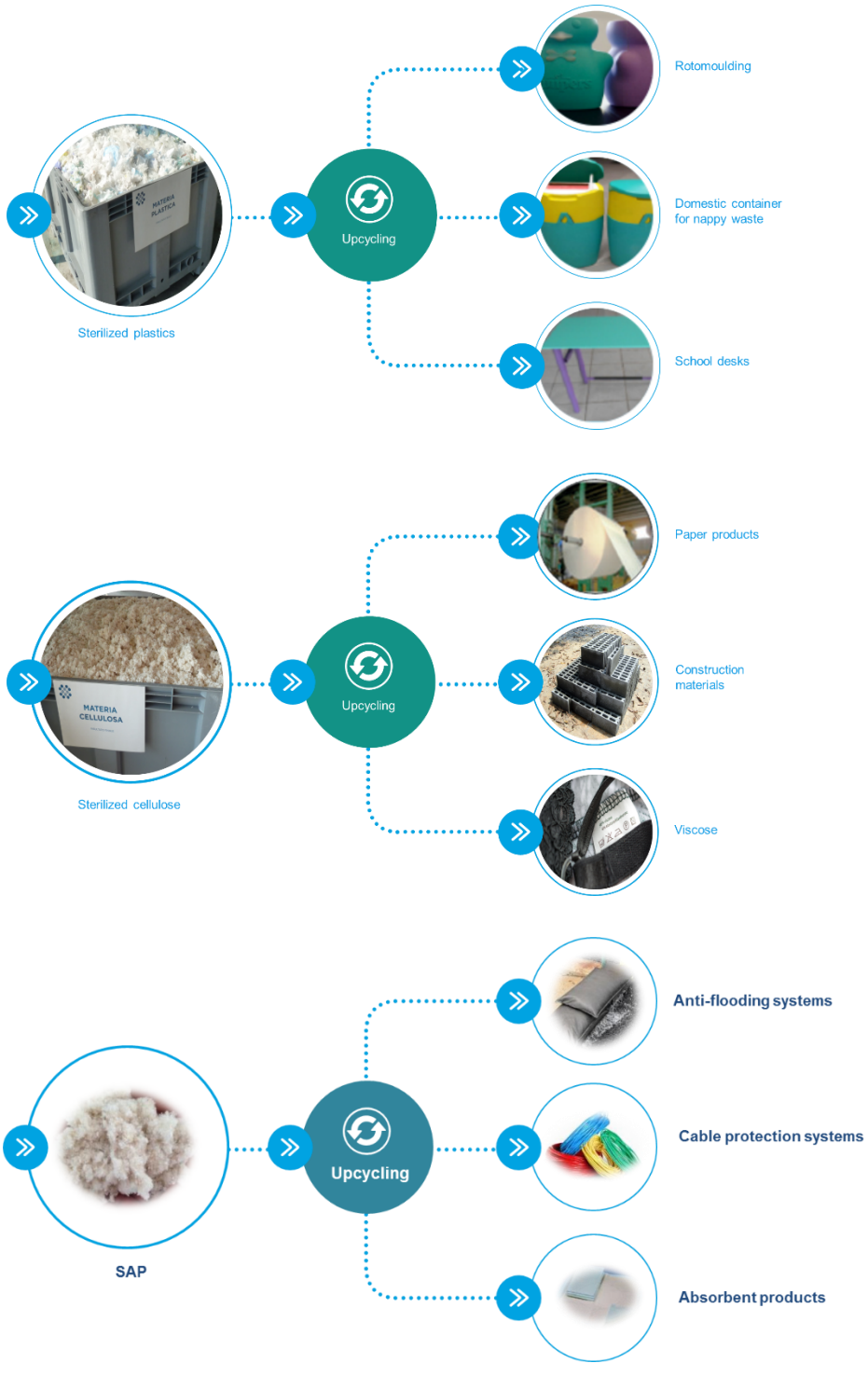
Fater's recycling technology is the first-of-its-kind in the world, as current alternative treatment technologies for AHP waste are incineration or landfilling. It represents therefore and absolute novelty compared with the alternatives currently in operation.

Positive and negative consequences on economic aspects

The pre-requisite for the implementation of AHP waste recycling in a given territory consists in the set up of dedicated waste collection services for this specific waste stream. These collection services can be implemented for households, but one of the main target for such collections is represented by elderly nursing homes and hospitals, where AHP waste are produced in relevant quantities.

Even though the implementation of this dedicated waste collection service could imply additional collection costs for the institutions, such costs could be easily off-set by the optimization of the collection service for the residual (non-recyclable) waste fraction, where generally the AHP wastes are collected, and by the reduction of the amount of residual waste sent to final disposal (landfilling or incineration).

The costs of recycling, indeed, can be generally very competitive vs landfilling and incineration, thanks in particular to the revenues obtained by selling the recovered secondary raw materials. The secondary raw materials are generally of a better quality compared to the equivalent recycled materials. That justifies a valorisation in the making of higher added value products and strengthens economic sustainability of the project as a whole. Some examples of the applications are shown in the pictures below.



Positive and negative consequences on ecological aspects

The environmental benefits of the recycling technology are much higher than its very limited "in situ" impacts. Fater's technology, indeed, consists in the recovery of valuable materials (plastic, cellulose fibres, SAP) to make other products, thus reducing the need for virgin materials to be extracted and reducing greenhouse gas emissions and energy use.

The greenhouse gas emissions and energy implications of the recycling process, with reference to the first plant installed in Italy, have been analysed based on a Life Cycle Assessment (LCA) approach, consistent with the ISO 14040 international standard. The main results with reference to 1 tonne of AHP waste are summarized in the table below. As it can be observed, the end of life of diapers in the recycling scenario becomes carbon negative, i.e. the recycling process recovers all greenhouse gas emissions generated by collection and processing of AHP waste and provides even an advantage of 168 kg of CO_{2eq} per tonne.

Main results of the comparison of CO_2 emissions per ton of AHP waste for Business as Usual (BAU) and recycling scenario

	RECYCLING scenario	BAU Scenario
Kg of CO_{2eq}/t generated in the AHP waste collection phase	28	11
Kg of CO_{2eq}/t generated in the AHP waste treatment process	177	422
Kg of CO_{2eq}/t avoided	-373	-166
CO_{2eq} balance	**-168**	**267**

This result means that running an AHP recycling plant at full capacity (10,000 t/year) allows saving yearly about 3,000 tonnes of CO_2 emissions, equal to the emissions of over 1,100 vehicles in a year.

With reference to the recycling process, for a plant with an annual capacity of 10,000 t/year of AHP waste, it is expected the recovery of 3,000 t/year of secondary raw materials, with an equal saving of primary raw materials.

Positive and negative consequences on the well-being of the users

As described in the previous paragraphs, Fater's technology provides an outstanding solution for the improvement of the disposal and processing of AHP waste, with regards to both the ecological and economic aspects. The solution has positive consequences also on the well-being of the users, as it allows to use the superior performing hygiene absorbent products available on the market, improving at the same time the environmental and economic performance of the whole products' life cycle.

Positive and negative consequences for the caregiving staff

As already pointed out, a pre-requisite for the implementation of AHP recycling is the separate collection of this waste stream, which implies an effort of the caregiving staff in diverting AHP waste from the residual waste fraction currently sent to final disposal. This could lead at the same time to significant savings, especially if this segregation effort is extended to other non-offensive waste streams generated in the elderly care facilities (i.e. packaging waste, food waste), since medical and residual waste treatment involves significant costs.

This action can be generally implemented with the support of the waste management company in charge of waste collection at the elderly care facility, with relevant potential for improving the safety of the care staff, through the following actions:

- Improve the knowledge of the various fractions, arising and current practices of the facility by organising waste audits;
- Organise training sessions to:
    - Help elderly care facilities with the definition of the waste management system by establishing clear categories of waste to be sorted and precise guidelines;
    - Raise awareness among the care staff and explain the rules for waste segregation;
    - Address non-compliances identified during audits or during the handling of waste by the facility management staff.
- Provide information material (posters, indications on containers…) to help the staff with the instructions;
- Monitor the results and impacts of the action by defining a set of key performance indicators (on risk management and financial savings).
- Install adequate and best performing waste containers.

The services described here can either be integrated in the tenders issued by healthcare facilities for the handling of their waste, with no additional costs for the elderly care facilities.