

# Dealing with diapers – the dirty little secret of organics diversion

By John Nicholson

According to the National Waste Characterisation Report on the Composition of Canadian Residual Municipal Solid Waste (MSW) released in 2020, approximately 3% of the total quantity of MSW is comprised of disposable diapers and incontinence materials. Most of these disposal diapers are rejected by most organics processing facilities in Canada and are currently landfilled.

In the days of our grandparents, cotton diapers were used for infants and small children. After use, the exercise of washing and drying them was the norm. Today, most people use disposable diapers, as they are convenient to use and easy to dispose of.

Disposable diapers consist of an outer shell (mostly polyester, polyurethane foam or synthetic rubbers), super absorbent polymers, cellulosic fibres, as well as minor amounts of tapes, elastics, and adhesive materials. After their use, they then include human waste.

The average weight of a diaper varies depending on the size and age of the user. As such, the effectiveness of diaper recycling should be based on the percentage/weight reduction and organics recovered as opposed to the total amount processed.

## MUNICIPALITIES AND SOURCE SEPARATED ORGANICS

Many communities today have Green Bin Programs (the curbside collection of source separated organics or SSO). A simple way of capturing diapers and incontinence materials for recycling is to include them within the allowable items in SSO collection programs.

In Canada, several municipalities, including Toronto and York Region in Ontario, are accepting diapers and incontinence materials as part of their SSO programs. Accepting diapers as part of an SSO program increases the participation rate in the program. As a



Many communities today have Green Bin Programs, which allow the curbside collection of source separated organics. Credit: Olha, stockadobe.com

result, Toronto is collecting around 200 kilograms annually of SSO per single family home. Diapers represent around 9% of the total amount of organic waste collected.

Once collected, diapers diverted from landfills can be co-composted, or co-processed through anaerobic digestion (AD). Many municipalities have come to the realization that co-composting is energy intensive, produces a compost with a quality dependent on the collection program, and has a positive carbon footprint.

On the other hand, AD has a net negative carbon footprint. Also, it creates a fertilizer product as well as biogas, which can have several revenue generating uses.

## ANAEROBIC DIGESTION PROCESS

Municipalities are increasingly moving towards AD for the processing of SSOs because of revenue generated through the production of energy by converting biogas to consumable products. These include direct heat, electric-

ity and renewable natural gas (RNG). The other reason for the shift to AD is its negative carbon footprint.

The processing of diapers as part of an SSO program can be challenging. All SSO AD facilities require pre-processing, so that non-organic materials are removed. Most pre-processing systems currently in use remove the bulk of the diapers from the SSO stream for eventual landfill disposal, without actually removing the organic content.

The key to successfully managing diapers in an SSO program is to have an efficient pre-processing system that separates the digestible material contained in the diaper from the non-digestible portion (mostly plastics).

## SUCCESSFUL PROCESSING OF DIAPERS

One company that is successfully processing diapers is CCI Bioenergy Inc. (CCI), a subsidiary of Evergreen Environmental Inc. CCI Bioenergy's patented BTA® process is the key to the suc-

successful management of diapers in an AD facility. BTA's patented hydro-mechanical pre-treatment solution is based on the process of hydro-pulping incoming materials before the AD process. It is currently used at many AD facilities in Europe, as well as in North America.

CCI BioEnergy is the exclusive North American partner for BTA supplied process. In Canada, the BTA process is used at the City of Toronto's Disco Road AD facility. Veolia, in partnership with CCI BioEnergy, is operating the Toronto facility.

In general, the BTA hydro-pulping process focuses on de-fibreing of organic materials to enhance the subsequent AD process, removing non-biodegradable heavy contaminants (stones, large bones, batteries, metallic objects, etc.) and the removal of the light fraction of non-biodegradable contaminants, such as textiles and plastic.

In separating the non-organic from the organic waste, its process does not destroy the non-organic components to the point where it is impossible to extract them from the process.

Using recycled process water, the BTA pulping solution uses both force and friction as the tools to accomplish its goals. This pulping solution uses radial and concentric flows to create high shear stress in the water/organic material suspension inside the pulper. This action not only opens bags, it also separates organic materials from inorganic materials and pulps the organic fraction, including the organic fraction from diapers and incontinence materials.

After the pulping process is completed, the waste-suspension is extracted through a sieve plate with a perforation limit of 10-mm at the bottom of the pulper. In a second step, the pulper is filled with process water and the light fraction (mostly plastics) is now cleaned and removed via the BTA hydraulic raking system.

The following steps are essential for effective separation of the non-digestible portion of SSO:

- Defibration and dissolution of the digestible substances by the shear forces introduced in the pulping process;
- Sieving of the produced suspension via the screen at the pulper bottom, which prevents the non-digestible

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impurities, such as plastic films, etc., from being discharged.

Plastics, including the non-organic outer shell of the diaper are efficiently and effectively removed for disposal or alternative use.

After the extraction of the pulp, via the perforated sieve, the organic suspension is then passed through BTA's grit removal system, where grit, sharps and fines are removed. The resulting clean pulp is stored in a pulp buffer tank and subsequently fed into anaerobic digesters, where the organic materials are converted into biogas digestate.

Generated biogas can subsequently be used to generate heat or electricity, or be further processed to produce RNG or green hydrogen. The digestate is of high quality and can be converted into a valuable fertilizer product.

### COMPARISON OF DIAPER RECYCLING IN A SSO VS. LANDFILLING

Municipalities considering the inclusion of diapers in their source separated organics program should not ignore the value of diaper recycling through anaerobic digestion processing—if appropriate pre-processing technologies are used. At first glance, it represents a significant diversion of organic waste from landfills and in addition, generates multiple value-added products, such as biogas products, fertilizer products and greenhouse gas related benefits. It also contributes to the increased participation and credibility of source separated organics collection programs. ■

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