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A Circular Healthcare Economy; a feasibility study to reduce surgical stainless steel waste

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ABSTRACT

The Circular Economy faces a growing interest. The aim of this study is to determine the feasibility of a circular approach towards reusing discarded hospital instruments and stainless steel waste. Secondary, this study aims to identify if any cost savings can be realized by following a circular instrument repair and recycling approach. During 6 months SS waste from three hospitals was collected. Both repair as well as recycling possibilities were evaluated by analyzing the waste composition and by calculating the percentage of SS that could be recovered and turned into raw material. Cost savings were calculated for three categories: (1) extending the life cycle of instruments by repair instead of disposal, (2) recycling of instruments by means of melting it into raw material, and (3) savings on waste handling costs.

A total of 1,380 kg instrument waste was collected of which 237 kg was refurbished and returned to the hospitals for being put in use, resulting in savings of € 38,868 (1). Of the 1,143 kg SS instruments, sheet material was made to manufacture components for new instrument baskets. The SS revenues of € 1,040 were sufficient, covering logistical and disinfection costs (2). The hospital savings on waste costs were € 316 (3). The total gain for the hospitals were € 39,184.

These results indicate that circularity as a sustainable model could provide a basis for a new approach in surgical waste management, realizing cost savings and environmental benefits on the long run.

1. Introduction

Since health care waste has a negative impact on the environment, medical personnel personnel should take environmental costs as a result of health care into consideration and focus on how to reduce material and energy consumption (Jameton et al., 2001). The use of resources, materials and energy in healthcare have been growing tremendously over the years. Literature has been increasingly reporting the adverse effects on human health as a result of declining environmental conditions and generated waste (Jameton et al., 2001; Leaf, 1990; McMichael, 1993; Haines et al, 2000; Solomon GM and Schettler, 2000; Chivian, 2001).

The global growth of healthcare waste has not only been the result of the growth of the population. Also the number and size of hospitals and growing use of disposable products contributed significantly (Mohee, 2005). Literature described a variety of classifications of health care waste. However, during the recent years studies identified two streams of health care waste: hazardous (mostly infectious waste) and non-hazardous (municipal solid waste) fractions (Minoglou et al, 2017). Non-hazardous waste streams from health care institutions form up to 80% of the total health care waste stream (WHO, 2016).

Several studies showed waste production in hospitals ranging from 0.5 to 2.0 kg per bed per day (Madhukumar & Ramesh, 2012) to 4.89 to 5.4 kg per patient per day depending on the size of the hospital and the activities (Hamoda et al, 2005).

A study conducted in 2010 with collected data from 12 hospitals ranged from 0.25 to 2.77 kg bed per day (Sanida et al, 2010) where Kane reported in 2017 numbers rising from 0.44 kg per patient per day in the republic of Mauritius to 8.4 kg in the US (Kane et al, 2017) with European countries resulting around 3.3 to 3.6 kg per patient per day. Approximately 5.9 million tons of hazardous (15%) and non-hazardous medical waste is disposed in the USA by hospitals every year (85%) (Yazdani et al, 2020). The pro-

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duction of carbon dioxide emissions as a result of this equals 8% (Voudrias, 2018).

Medical instruments being part of hospital waste can be considered as both hazardous and non-hazardous waste streams. Disposable instruments intended for single-use are part of hazardous waste streams and reusable instruments part of non-hazardous waste as they are disinfected and sterilized each time after use. Typically and according to hospital procedures, reusable instruments need to be disinfected first after which they are examined in the CSSD and sterilized thereafter. Hospital instruments are highly critical products since they are required for carrying out surgical procedures. This paper examines the feasibility of reusing medical instruments extracted out of the waste streams from a perspective of the Circular Economy.

The Circular Economy faces a growing interest around the globe as it may generate economic benefits to society (Van Berkel et al, 2019). Already in 2014 the World Economic Forum (World Economic Forum., 2014), reported potential benefits of the Circular Economy regarding the use of less energy and material inputs. Although there are many definitions, the Circular Economy may be best described as being an economic system in which waste is prevented, minimized or even completely reused (Geissdoerfer et al, 2017). Circularity may therefore be considered as an economic model in which, amongst other aspects, waste is being reused again and again.

However, the Circular Economy also requires other aspects than the reuse of waste only. These are e.g., the circular (re) design of products, the use of specific materials, recycling, reselling, repurposing, repair, refurbishment and remanufacturing. These aspects have the objective to prevent the generation of waste and to drastically limit the use of natural resources. The Ellen MacArthur Foundation defined the Circular Economy as “an industrial economy that is restorative or regenerative by intention and design” (MacArthur, 2013). Being restorative by means of circulating resources into the economic system is in contrast to a linear economy which is based on a ’take, make, dispose’ model of consumption patterns (World Economic Forum., 2014). The linear economy uses raw material on a single-use basis resulting in putting pressure on the earth’s natural resources.

McGain reported in 2010 that in healthcare the use of pharmaceutical materials and medical devices resulted in higher carbon dioxide emissions as compared to the energy consumption and transport together (McGain et al, 2010). McGain also showed that the use of disposables in the medical field have been growing significantly and that the decision to purchase a medical product did often not include environmental impact considerations. As hospitals lose a lot of money by following traditional ways of dealing with Stainless steel waste, the aim of this study was to determine the feasibility of a circular approach towards reusing hospital instrument waste, in particular surplus Stainless Steel instruments and other stainless steel waste. With this study we want to demonstrate the viability of reprocessing surgical instruments as a circular process which may positively contribute to waste prevention, cost savings and environmental impact.

For this study the following research question was formulated:

> “Can cost savings be realized when using repair, refurbishing, recycling as methods to reach a concept of closing the circular loop in a hospital environment?”

Most of the discarded instruments and stainless steel (SS) medical waste contain valuable materials that can be reused; having good resistance against corrosion or having titanium alloys and even ceramic and polymeric materials (Mainier and Fernando., 2013). Surgical instruments are typically manufactured out of SS. This material represents iron (Fe)-based alloys containing a percentage of Chromium (Cr) and Nickel (Ni). Furthermore, it typically contains alloying elements such as Molybdenum (Mo), manganese, carbon, nitrogen (N), phosphorus, sulfur, and silicon (Weihong and Paul, 2019). SS has mechanical properties and corrosion resistance which can be enhanced when alloying with Chromium (Cr), Nickel (Ni), Molybdenum (Mo), and nitrogen. Most often SS316 is used for surgical instruments and SS304 for instruments and instrument related accessories such as instrument mesh baskets and stainless steel disposable products. Surgical instruments in general are manufactured out of SS316 and SS304 according to DIN EN ISO 7153-1 (Pezzato et al, 2016).

Both types of SS that are often used within the Operating Room are recyclable by means of melting and reprocessing. According to the Australian Stainless Steel Association (ASSA), SS offers good prospects for recycling (ASSDA, 2019). They state that SS’s long service life, 100 percent recyclability and its valuable raw materials make it an excellent environmental performer. Moreover, the ASSA indicates that SS contains valuable raw materials like Cr and Ni which makes recycling SS economically viable (Broadbent, 2016). SS is actively recycled on a large scale whereby it involves remelting scrap to manufacture new steels without changing the properties of the material, resulting in a closed loop. (recycled SS) (Broadbent, 2016). SS objects should never become waste at the end of their useful life. Instead, recycled SS objects should be systematically separated and recovered and lead back into the production process through recycling.

To demonstrate this feasibility, an experiment was initiated focusing on prevention of SS waste by a combination of repair of the discarded instruments and melting SS waste into new raw materials when they could not be repaired anymore. Three Dutch hospitals, including Westeinde Ziekenhuis, Bronovo in The Hague, Maasstad Hospital in Rotterdam and Amsterdam University Medical Center, location VUmc in Amsterdam, participated to determine the feasibility of this research in a small scale experimental set-up.

2. Methods

During a period of nearly 6 months between 25 September 2018 – 12 February 2019, discarded reusable as well as disposable instruments and SS waste from the Operation Room (OR) of the affiliated hospitals was collected. The waste collection and handling was managed by a Dutch medical supplying and instrument repair company named Van Straten Medical (VSM, De Meern-Utrecht, The Netherlands).

Most instruments were disinfected through standardized disinfection programs at 90°C in disinfectors at the supplying hospital site, except the disposable instruments from Bronovo Hospital, these were disinfected at VSM. After the transport bins were filled, the hospitals contacted VSM and the waste was collected and brought to the storage containers at VSM. In a first step, the waste composition was analyzed by instrument technicians and divided into SS instruments that could be recovered/repaired, and SS that could be recycled and turned into new raw SS material. The collected SS material was separated by indication of material and use (e.g. SS304 used for trays or baskets and SS316 for surgical instruments) in two different containers. In case of doubts a strong Neodium magnet was used for identification as both material types have different attraction to a magnetic field.

The metal recycling company collected the recyclable SS material at VSM when the containers were full and had the materials melted into new sheet metal. The sheet material was acquired from the same metal recycling company that collected the material from VSM and used to manufacture components for instrument mesh baskets and for SS components used in instrument fixation. The sheet metal plates were processed on a water jet cutting machine to cut components for surgical instrument mesh baskets and components for instrument mesh basket instrument fixation. The

Fig. 1. Left: Two carts filled with mesh baskets filled with instruments from Maasstad Hospital Right: Circular bin with discarded instruments at Van Straten Medical.

leftover machining material was returned to the circular container to be picked up for melting. In this way no material waste would be generated during the process.

The hospital costs with respect to waste disposal varies per hospital and per contract the hospital negotiates with the waste processing company. The costs for waste removal at the hospitals consists out of a price per kg waste removal and costs for using additional accessories such as costs charged for special waste containers, additional transportation costs and other associated and handling costs. Also costs such as electricity, costs for overhead and logistical costs were calculated for the period of this study. The costs for electricity were based on an allocation of the electricity which was assigned to the area where the waste was stored as well as the area for refurbishment of the instruments and part of the overhead associated with the reprocessing of the waste. The stainless steel revenues however is dependent upon the applicable market price for SS.

The routing, disinfection, refurbishment and transport costs were based on the costs as made by VSM. All handling and storage costs, employee costs and process handling fees were calculated over the period and extrapolated over the total amount of collected waste in this study.

In this study we concentrated on three main cost cycles associated with stainless steel waste:

(1) **Non-contaminated instruments collected which could be refurbished/repaired.** Both the average repair price as well as the price for a new instrument were calculated over all instrument used in the hospitals.
(2) **Recycling of contaminated and non-contaminated SS instruments** which could not be repaired.
(3) **Saving of direct cost for waste handling**, because less waste is produced. In general the hospital costs for waste disposal can be divided into two categories: general waste and contaminated waste. Both categories are charged differently by the waste processing companies. The costs are invoiced with build-up expenses per tons of waste, added with rental charges of waste containers, cassettes, handling fee and other expenses.

The numbers to calculate the costs depend on the amount of waste in the specific categories. These results are provided in the results section. To prevent repetition, the method to calculate the costs are therefore provided in the results as well. For ease of calculations, all costs were related to units equivalent to 1,000 kg (ton).

3. Results

A total of 1,380 kg waste was collected from the three participating hospitals. The waste consisted of instruments used for basic surgery like scissors and bone cutters, but also instruments for more specialized surgery such as catheter intervention or minimally invasive surgery (Figure 1). Furthermore, mesh baskets, wire baskets and stainless strays were identified. The first inspection showed that 20 % of the waste consisted of instruments that were in good enough condition to be repaired. The remaining discarded instruments consisted of older model instruments that were taken out of rotation or instruments that showed corrosion, color changes, partial loosening of its surface layer or pitting.

From the 1,380 kg, 50 kg consisted of disposable SS instruments which were collected separately in a closed container. 1,330 kg was found to be surplus SS instruments and surplus mesh baskets (Table 1). All stainless steel waste, consisting of SS316 and SS304 was melted and recycled into sheet material. The total amount of waste per hospital category are provided in Table 2. The distribution over type of waste (refurbished and recycled) per hospital is provided in Table 3.

A total of 945 instruments were refurbished into new manufacturing's condition. For Maasstad the number of instruments were 282 instruments, for Haaglanden MC 478 instruments and for VUmc 185 instruments. The average weight per instrument was 251 g, totalling 237 kg.

3.1. Costs Calculations

An overview of the costs and savings per kg and per 1,000 kg used in the calculations of costs are provided in Table 4. Shipments were made with a total of 237 kg resulting in an average price of 0.10 €/kg for logistics and transport for Haaglanden Medical Center (HMC) consisting of Westeinde, Bronovo, Antoniushove as well as for VUmc and Maasstad hospital in the study period. These costs were based on a standardized transport pallet price of € 50/pallet, independent from the distance in The Netherlands and having an average weight of 500 kg per transport (company, location, date). Although in this pilot study the collected SS waste was in smaller portions, we expect that threshold waste volumes can be easily reached, therefore, the calculations were conducted with the standard transport pallet prices.

The costs of the transport bins in which the instruments and other stainless steel waste were disposed, was calculated on € 25/bin based on its purchasing cost price including other minor

Table 1
Collected instruments.

Collected	Material specification	Collected weight (kg)
Reusable instruments and mesh baskets	Mixed SS304/SS316	1,330
Disposable instruments	SS304	50
Total		**1,380**

Table 2
Collected waste types and distribution per hospital category.

ospital	Type of hospital	Type of waste	Waste collected (kg)
Maasstad Hospital, Rotterdam	Large peripheral	SS baskets, containers, discarded instruments	717
Haaglanden MC, The Hague	Merged hospital consisting of Westeinde, Bronovo & Antoniushove	SS baskets, discarded instruments, used disposable instruments	209
AUMC, loc. VUmc, Amsterdam	Academic Hospital	SS instruments, baskets	454
Total			**1,380**

Table 3
Circular processed waste.

	Collected (kg)	Refurbished (kg)	Recycled mixed (kg) SS 304/316	Disinfected & Recycled (kg) SS 304
Maasstad	717	71	646	
Haaglanden MC	209	120	39	50
VUmc	454	46	408	
Total	**1,380**	**237**	**1,093**	**50**

Table 4
Conversion of costs and savings for VSM per 1 kg and per 1.000 kg.

Costs	(€/kg)	(€ per 1,000 kg)
Transportation costs	0.10	100
Collection bins	0.07	70
Handling costs	0.01	10
Disinfection costs	0.15	150
Overhead costs	0.01	10
Total logistical costs	**0.34**	**339**
Savings		
Steel revenue	**0.91**	**910**

Table 5
Total savings and savings per kg obtained by refurbishment/ repair.

	Refurbished instruments (kg)	Savings from refurbished per instrument kg (€)	Savings from refurbished instruments as compared to new (€)
Maasstad	71	164	11,644
Haaglanden MC	120	164	19,680
VUmc	46	164	7,544
Total	**237**		**38,868**

costs such as stickers and paper work. For the three hospitals amounting to € 100 which was divided over the total collected batch of 1,380 kg, resulting in € 0.07/kg. The costs for disinfection of contaminated instruments were calculated at € 0.15/kg. The handling costs as well as the overhead (incl. storage) costs at the supplier, Van Straten Medical (VSM), were calculated to be € 10/ton each, consisting of overhead costs calculated to be € 7/ton and allocated electricity and employee costs of € 3/ton.

3.2. Savings by repairing instruments

A total of 237 kg resulted in refurbished instruments. The savings were calculated as compared as shown in table 5 to replacing them with new instruments. The average costs of refurbishment were € 39 per 250 g. The average sales price of a new instrument of € 80,- was based on the average sales price of a total of 16,912 SS instruments offered by VSM in the market. The average costs price of a new instrument is € 80 resulting in savings of € 41 per instrument equaling 250 g resulting in savings of € 164 per kg. SS prices, prices of refurbishing instruments, price fluctuations of new instruments and possible extra costs may vary per hospital and per country, resulting in potential variations in net gains for hospitals. Both the costs as well as the savings of the 50 kg disposable instruments from Bronovo hospital were higher as this concerned contaminated disposable instruments. These instruments had to be disinfected at VSM, costing 0.15 €/kg. The savings on Bronovo hospital were higher as it resulted in preventing higher medical waste costs of 1 €/kg.

3.3. Costs for recycling

A total of 1,143 kg mixed SS 304 and SS 316 were collected by a metal recycling company Independent of the grade, an average price of 0.91 €/kg, as calculated from the credit invoices, was paid by the collecting metal recycling company, resulting in a revenue of € 1,040 for VSM. Although the total of received SS revenues were sufficient to cover the costs for bins, logistical and disinfection costs for VSM, further optimization of the process is needed in order to decrease the costs and to create a sustainable business model.

3.4. Direct hospital savings costs on waste handling

To establish a cost prize for hospital savings on waste, the waste disposal invoices of the affiliated hospital were averaged resulting in € 0.20 per kg general waste and € 1,- per kg contaminated waste. These cost prize indications include all expenses made by the waste processors. Other related costs which were taken into account were transport costs for collecting the waste and costs of transport bins in which the hospitals deposited their discarded instruments and SS waste as well as cleaning and disinfection costs for contaminated waste and handling, storage and overhead costs.

Table 6
Net gain for the participating hospitals.

	Direct hospital savings on waste costs (€)	Savings from refurbished instruments as compared to new (€)	Total gain for hospitals
(€)			
Maasstad	143	11,644	11,787
Haaglanden MC	82	19,680	19,762
VUmc	91	7,544	7,635
Total	**316**	**38,868**	**39,184**

An overview of the savings from refurbished instruments**,** reduced waste cost and per hospital is provided in Table 6. More details of the calculations and obtained data can be found in supplemental file 1.

4. Discussion

The environmental quality may be improved while handling the SS waste. Health care waste demonstrated to have a negative impact on the environment which may be reduced by including handling SS waste in a circular way (Viani et al, 2016). Environmental impacts have grown as a result of the use of disposable instruments including stainless steel disposables (Ibbotson et al, 2013). Furthermore, literature has been increasingly reporting the negative effects of medical waste (McGain et al. – 2010). This study examined the feasibility of collecting hospital ss waste, processing it circularly by means of refurbishment or recycling of the material in order to prevent it to become landfill- or incinerated waste. In some countries the ratio of used disposable instruments may vary between plastics and ss versions. The ss instruments which are used in the Netherlands were used as basis for this study and included needle holders, scissors, tweezers, and instruments part of suture sets. In certain studies waste was related to kg per bed or patient (Madhukumar & Ramesh, 2012), (Hamoda et al, 2005), (Sanida et al, 2010), (Kane et al, 2017). However, in our study waste was calculated in kg collected directly from the Operating Rooms or CSSD. Therefore it is needed to know the number of beds of patients in each hospital for qualitative comparison.

The instrument repair demonstrated that both instruments for general surgery as well as instruments for specialized surgery could be repaired and brought back into circulation. The savings in the refurbishment or repair category were the highest as compared to the other two categories of recycling and waste disposal. The inspection before repair showed that the quality of instruments and its basic materials are of great importance for increasing the life span and therefore, contributing to preventing an instrument being discarded in earlier phase. It should be considered by the hospital buyers that factors such as resistance against pitting and crevice corrosion have an influence on the longevity of the instruments and therefore, on the amount of waste in a certain time period. The costs associated with repair and refurbishment were 49% of the average purchase costs.

Instrument with circular and sustainable designs such as the new modular instruments developed for advanced endoscopic surgery seem to be more sustainable in terms of cost-reduction due to a reduction in repair time (Hardon, 2019). These type of instruments can have a major contribution to surgical circularity as they include in their design, detachable parts which can be replaced in case of malfunctioning.

Due to the complexity of financial flows in hospitals and vulnerability of these flows, especially for teaching hospitals (Liu et al, 2011), it proofed difficult to calculate the exact cost prices of each procedure as well as the exact costs of waste disposal. Differences in Total Cost of Ownership and economic advantages of circular reuse of materials or reusable instruments versus disposable instruments are based on assumptions and need to be studied further. This study used the unit kg/bed/patient and related to the SS instruments' waste cane be measured in-terms of kg/bed/patient

Comparative calculations where reusable instruments are compared to disposable instruments often equal to sterilization costs versus purchase costs of disposable instruments. Advantages such as longevity of the reusable products are often neglected during these calculations (McGain et al. 2010). McGain argues that “a cause of a trend of using the disposable or single-use products which continues to increase as they are supposedly a more cost-effective option. Many single-use products replaced the conventional long-lasting SS products for daily hospital practices. Subsequently, the environmental consideration is increasingly gauged into one of the criteria of the consumer purchasing decisions due to the rising concerns in resource scarcity, human health and quality of ecosystem”. Since purchasing decisions are complex regarding this matter, knowledge on circular public procurement aspects may improve these decisions (Sönnichsen and Clement, 2019). It will be a challenge to make balanced choices, based on costs comparisons which incorporate all costs. These costs need to include increase of costs due to the price increases of extracting natural resources and converting them into raw materials, increasing shipment and delivery costs, packaging, sharpening medical (MDR) regulations, environmental costs and ecological impacts. Taking these into account, the reuse of waste and materials can have a major positive impact (Herrmann et al, 2015). Circular projects such as this study experienced great enthusiasm among hospital staff and provided insights in the potential reusability of surgical waste.

The cost price to collect and process stainless steel waste was 0.17 € / kg. Compared with the revenues ranging from 164 €/kg repairable clean SS material to € 0.93 / kg for clean SS waste and € 1.42/ kg for contaminated SS. It was therefore, demonstrated that this step in circular instrument management is feasible and even profitable.

4.1. Suggestions for further work

Viani (Viani et al, 2016) reported in 2016 recovering value from used medical instruments however, the reuse and reprocessing of disposable medical devices, faces international issues and difficulties as well as demanding ethical considerations, high standards of reprocessing and factors such as regulations, clinical challenges regarding safety and sterility (Popp et al, 2010).

Further research in recycling, refurbishment, remanufacturing, and reuse of surgical products with a focus on energy consumption during the melting process and CO_2 footprint is needed to understand the true impact of this type of circular instrument management. For this a Life Cycle Analysis (LCA) could be conducted. Although out of the scope of this study, such a LCA can be used to quantify the environmental impacts of the different phases in instrument repair, refurbishment, remanufacturing and recycling of SS waste. Such Assessment of environmental impact can be made according to standards such as ISO 14040 and ISO 14044 (ISO/FDIS, “ISO 14044, 2006, ISO/FDIS, “ISO 14040, 2006).

Furthermore, focusing on a design for the circular economy, including aspects such as design for recycling as well as design for disassembly, contribute to realizing product sustainability (Kane et al, 2017). Studying the applied materials, their recycling rates and transforming these into new medical devices may contribute to material life extension. These studies should further identify which alternative processing steps could reduce the energy consumption, processing and transport times and thus CO_2 footprint associated with hospital waste when circular reprocessed. These study findings may be incorporated into business modelling methods contributing to an increase of sustainability as they still hardly focus upon (Guzzo, 2019). As a result, the research outcome may lead to successful Circular business models in healthcare which are defined as sustainable business models typically focussing on Circular Economy aspects (Geissdoerfer et al, 2018).

Our results indicate that hospital cost savings can be realized as a result of lower instrument repair as compared to higher instrument replacement costs and by minimizing waste costs.

4.2. Limitations

Although there seem no major fluctuations in waste production during a year which could not be accounted for during the six-month period of this study, however there might be fluctuations as a result of expanding or decreasing variations in number of surgical procedures. The results of this study are based on the six-month period which might differ when assessing longer period.

This study emphasizes on repair and recycling of medical instruments as selected R strategies. However, when a new component was needed such as a screw the R strategy changes towards remanufacturing of the instrument. To include this type of events, a framework such as described by Morseletto (Morseletto, 2020) can be used to define these activities as circular economy strategies as it includes refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle and recover as different R strategies. Although we divided stainless steel waste into 304 and 316, it can be interesting to conduct a contribution/sensitivity analysis for deeper understanding of the type of material waste and how it is liked to different surgical disciplines including possible cost fluctuations.

5. Conclusion

The results of this circular pilot project conducted with 3 hospitals indicated thAt circular reprocessing of SS waste into new raw material and (re) manufacturing of new medical devices from SS hospital waste is feasible. Furthermore, circular reprocessing not only contributes to waste prevention but also saves costs related to contaminated and non-contaminated hospital waste disposal. From the 3 main waste reprocessing methods (repair/refurbishment, recycling and hospital waste disposal), the repair and refurbishment of surgical instruments, instead of replacing with new instruments, show to have the most potential in terms of cost reduction.

Finally, we demonstrated that circularity as a sustainable model could provide a basis for a new approach in surgical instrument and waste management having cost savings and environmental benefits on the long run.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.spc.2020.10.030.

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