

Life-cycle of Post-consumer Mattresses: Waste Streams and Recycling Challenges

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1. Introduction – Post-consumer mattresses present disposal challenges to society because mattresses are bulky, of low density, of mixed material composition and are readily contaminated by moisture ingress. Disposal to landfill is environmentally unsustainable and planned changes to the UK taxation regime are set to make landfill disposal economically unviable. In the UK, over 6 million mattresses are disposed of annually, of which 1.4 million are diverted from landfill [1]. To increase mattress recycling rates, understanding of the mattress life cycle is needed, as from this, downstream markets for recovered materials can be evaluated, ultimately informing the economic model of the recycling process. Through manufacturer, recycler and down-stream/end user data collection and analysis from stakeholders based in the North West of the UK, this study reports the waste streams arising from post-consumer mattresses and discusses challenges to be addressed if recycling rates are to be increased above current levels.

2. Materials and methods – The mass and composition of materials arising from post-consumer mattresses was determined using data from mattress manufacturers based in the North West of England and from mattress recyclers located across the UK. This data enabled the calculation of materials contained in an idealised ‘average’ post-consumer mattress, having a mass 25 kg, and indicative of that produced by the UK mattress industry. Using literature values [1,2] and input from mattress recyclers and onward markets, the £/tonne market value of the mattress material waste streams was determined, and from that, the value of the average mattress in terms of the available material yield. Also considered were current and onward markets for the waste streams, and any associated processing requirements.

3. Results and Discussion – The materials contained within the average mattress defined in the study, and the £/tonne value of each constituent waste stream, are shown in Table 1. For the modelled 25 kg mattress of this study, the market value of the recoverable post-consumer materials is estimated to be £1-£3 per unit. The value of the waste streams, and thereby the economic viability of mattress recycling, will also depend upon local issues including location (collection and transportation costs to the recycler), access to onward markets, saved landfill gate fees and the collection charge paid by the consumer to dispose of the mattress. Consideration of these factors and the formulation of an economic model of mattress recycling is the subject of ongoing work by the authors.

Table 1. Average mattress composition

Waste stream	Mass percentage (avg. mattress)	£/tonne value
Open coil	27%	£160-80
Pocket spring	18%	£200-60
PU foam	15%	£150-50
Mixed textiles	9%	£90-(40)
Polyester	6%	£180-100
Shoddy felt	5%	Neutral
Other	20%	-

4. Conclusions – The economic yield of post-consumer mattresses is low, reflecting the low value of current downstream markets for recovered materials. Beyond changes to landfill gate fees, improvements in economic yield could be achieved through investment in waste stream reprocessing to improve material recovery rates and quality; through consumer collection/disposal charges and through taxation of manufacturers on the use of virgin materials where post-consumer alternatives are available (ie the polluter pays principle).

5. References

- [1] S. Slater, K. Baker, Mattress Component Recycling, National Bed Federation, UK. 2018.
- [2] T. Griffiths et al, Proc. ICE: Waste and Resource Management, 166 (2013) 158–166.