

Paper Recycling

Navneet Kumar

Department Of Chemistry

Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India

ABSTRACT: *Paper processing requires a variety of chemicals used either specifically in the production of paper and pulp or in the conversion processes (i.e. printing, gluing) that follow. Thanks to economic and environmental policies, the rate of paper recycling continues to increase. In Europe, recycling has grown by almost 20% over the last decade or so, hitting almost 72% in 2012. Increased recycling rates can involve poorer quality paper fractions. This may theoretically contribute to the aggregation or accidental distribution of chemical compounds in paper, e.g. by the incorporation of chemicals in waste paper into the recycling loop. This research offers an analysis of potentially paper-borne chemicals and introduces a sequential hazard screening protocol based on the inherent hazard, physico-chemical and biodegradability characteristics of the compounds. Based on the findings, 51 compounds (selected mineral oils, phthalates, phenols, parabens and other classes of chemicals) were listed as potentially important to the recycling of paper. It is recommended that more attention be paid to these chemicals in the waste paper.*

KEYWORDS: *Chemicals, Paper, Recycling, Waste Management, Environmental Issues, Wood, Production.*

INTRODUCTION

Paper recycling is one of the most well-established recycling programmes currently in operation for waste materials. Recycled paper is an important part of the production of paper and pulp, with an annual recycling consumption in Europe of about 72% in 2012. In addition to the fact that recycled paper is a valuable raw material for the paper industry, multiple studies have also shown that paper recycling can deliver major environmental benefits from a life-cycle perspective. Paper recycling[1] can also be seen as advantageous from both a resource and an environmental point of view and should be encouraged as much as possible. Although there is no question that a further rise in paper recycling rates can be accomplished in Europe, the quality of waste paper can eventually decline as more and more "marginal" paper fractions are obtained for recycling and the content of toxic substances in paper increases[2]. A detailed analysis of the chemical compounds potentially present in waste paper for recycling is also required in order to provide a framework for further assessment of the nature of waste paper as a resource and eventually also to sustain market awareness of recycled paper in general.

Paper processing and manufacturing processes typically consist of the following two phases: (i) production of paper and pulp by the paper industry (i.e. various grades of paper quality) and (ii) production of paper products by separate industries (e.g. periodicals, packaging materials, books, etc.). Chemicals in waste paper can come from a broad variety of sources, including purposely applied (i.e. additives, inks, pigments, glues, etc.), part of the reaction and/or biodegradation or

added during the paper usage process or during the waste management phase (e.g. cross-contamination from other waste materials during collection).

1.1 Paper making and recycling

Paper may be made from wood pulp or non-wood fibres[3]. Many developed countries do not have enough wood to produce pulp for paper processing and instead use raw non-wood content from agricultural residues for pulping. Examples of non-wood raw materials include wheat straw, rice straw and bagasse. Caustic pulping is used with non-wood raw materials to dissolve a non-cellulose organic fraction, such as lignin, and to leave a fibrous residue as a pulp for the manufacture of paper. Method steps for rice straw pulping begin by shredding the rice straw content and cleaning it with water. The shredded fibres are then cooked in a rotary digester to dissolve the lignin content while leaving the cellulose fibres[4]. Vacuum filters are then used to extract the fibres from the cooking liqueur. Fibers are then thickened by centrifuges and eventually bleached by chlorination producing pulp fit for use in the manufacture of paper.

1.2 Advantages of Recycling

1.2.1 The recycling process saves the environment. Using recycled paper to produce fresh paper decreases the number of trees that are cut down and conserves natural resources. Each tone of recycled fibre saves an average of 17 trees plus associated pulping resources. In some cases, recycling systems are cheaper than disposal services. Recycled paper preserves waste space and the volume of air pollution generated by incineration. Businesses will foster a healthy corporate and neighborhood reputation by starting and sustaining a paper recycling programme. Parents will encourage a healthier world and a safe lifestyle for their children by showing them the benefits of paper recycling[5].

1.2.2 By using waste paper to generate fresh paper, the issues of recycling are minimized. The savings are at least 30,000 litres of water, 3000–4000 kW h of electricity and 95 per cent of air emissions for every tonne of paper used for recycling. Even, 3 yd³ of the landfill space is saved. And in many situations, recycling paper will save communities money that they would otherwise have to expend on disposal[6].

1.2.3 Compared to virgin paper, the production of recycled paper amounts to between 28 and 70 per cent less energy consumption. Often, less water is being used. This is because much of the energy used in paper production is the pulping used to process wood into paper.

1.2.4 Recycled paper creates less polluting pollution of air and water. Recycled paper is not necessarily re-bleached, and oxygen rather than chlorine is usually used when re-bleached. which decreases the amount of dioxins released into the atmosphere as a by-product of chlorine bleaching operations[7].

1.2.5 High-grade paper can be recycled many times, delivering environmental benefits every time.

1.2.6 In fact, the processing of recycled paper produces between 20% and 50% less carbon dioxide emissions than the production of virgin fibre paper.

1.2.7 Since used paper is typically obtained very close to recycling facilities, the processing of used paper decreases transport and carbon dioxide emissions.

1.2.8 Recycling paper decreases the amount of waste while helping to support the local economy by processing and handling waste paper.

LITERATURE REVIEW

Paper processing requires a variety of chemicals used either specifically in the production of paper and pulp or in the conversion processes (i.e. printing, gluing) that follow. Thanks to economic and environmental policies, the rate of paper recycling continues to increase. In Europe, recycling has grown by almost 20% over the last decade or so, hitting almost 72% in 2012[8].

JobienLaurijssen et al in their research paper shares the study has shown that paper recycling has a positive impact on energy intensity and CO₂ emissions over the total life-cycle[9].

DISCUSSION

Various LCA and waste management studies have been published which address recycling trade and other end-of-life options for used paper. While this research did not rely on various alternatives for waste management, the results are consistent with several of these reports. Recycling is advantageous in terms of CO₂ pollution and (feedstock) energy consumption over the life cycle of the article. In addition, we find that the option of device boundary has a significant effect on the outcomes. Especially with regard to the in-or exclusion of surplus biomass which is made available by increased recycling. This research offers new perspectives into pulp and paper output of the entire country and the relative influence of individual grades of paper. We were also able to distinguish not just the variations in paper grades, but also the results of the recycling of various paper grades and of a combination of paper grades. It's important to point out that even though we were comparing the environmental effects of three different types of pulp, we do not wish to say that using one form of pulp is greater than using another type of pulp.

Recent studies have shown that paper and paper products can contain a high amount of chemical compounds, much of which can be correlated with the printing industry, where more than 7,000 chemicals can be used in food-packaging ink processing alone. However, relatively little comprehensive evidence is available on the presence of such substances in paper or paper waste

products. Most of the current studies target a particular category of chemicals or paper products, and the effort to classify any single chemical in paper has proven to be difficult.

CONCLUSION

This study has shown that paper recycling has a positive impact on energy intensity and CO₂ emissions over the total life-cycle. Recycled paper is a valuable raw material for the paper industry; multiple studies have also shown that paper recycling can deliver major environmental benefits from a life-cycle perspective. Paper recycling can also be seen as advantageous from both a resource and an environmental point of view and should be encouraged as much as possible.

REFERENCES

- [1] H. Grossmann, T. Handke, and T. Brenner, "Paper Recycling," in *Handbook of Recycling: State-of-the-art for Practitioners, Analysts, and Scientists*, 2014.
- [2] R. K. Pati, P. Vrat, and P. Kumar, "A goal programming model for paper recycling system," *Omega*, 2008, doi: 10.1016/j.omega.2006.04.014.
- [3] A. Villanueva and H. Wenzel, "Paper waste - Recycling, incineration or landfilling? A review of existing life cycle assessments," *Waste Manag.*, 2007, doi: 10.1016/j.wasman.2007.02.019.
- [4] S. Byström and L. Lönnstedt, "Paper recycling: Environmental and economic impact," *Resour. Conserv. Recycl.*, 1997, doi: 10.1016/S0921-3449(97)00031-1.
- [5] S. M. Al-Salem, P. Lettieri, and J. Baeyens, "Recycling and recovery routes of plastic solid waste (PSW): A review," *Waste Management*. 2009, doi: 10.1016/j.wasman.2009.06.004.
- [6] R. Miranda and A. Blanco, "Environmental awareness and paper recycling," *Cellul. Chem. Technol.*, 2010.
- [7] R. Jain, "recycled paper," *science direct*. <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/recycled-paper>.
- [8] K. Pivnenko, E. Eriksson, and T. F. Astrup, "Waste paper for recycling: Overview and identification of potentially critical substances," *Waste Manag.*, 2014, doi: 10.1016/j.wasman.2015.02.028.
- [9] J. Laurijssen, M. Marsidi, A. Westenbroek, E. Worrell, and A. Faaij, "Paper and biomass for energy? The impact of paper recycling on energy and CO₂ emissions," *Resour. Conserv. Recycl.*, 2010, doi: 10.1016/j.resconrec.2010.03.016.