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Sustainability of paper and paperboard as a contextual approach to applying systems thinking in chemistry education

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Abstract

About 4 billion trees are cut down each year to make wood pulp, which is then transformed into paper and paperboard. With world consumption of these products having increased four-fold in the last 40 years, it is important that paper/paperboard manufacture and use be considered in the broad context of global sustainability.

At the core of papermaking is a series of chemical processes which transform raw wood, via wood pulp, into products with applications such as printing, absorbents, wrapping, packaging and insulation. The chemical processes involved at different stages include a wide variety of reactions (e.g. acid and base reactions, hydrolysis, bleaching, decomposition on heating) and physical transformations (e.g. dissolution, evaporation, precipitation, gas generation) of inorganic and organic materials. For different applications, the production processes may introduce additives to affect properties such as strength, appearance, absorptivity, texture and colour.

This wide range of chemistry processes and products linked to applications offers many opportunities not only to learn chemistry in context but to extend this to build competence in systems thinking. The presentation will explore how systems thinking can be used to examine the consequences of chemistry choices about reagents and pathways, about waste- and by-product management approaches and about options for disposal/reuse/recycling of products after primary use. The Systems-Oriented Concept Map Extension (SOCME) tool, developed to assist systems thinking in chemistry education, will be applied to illustrate the discussion.

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