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Introduction: Gypsum in construction and demolition waste

Gypsum (calcium sulfate dihydrate) has excellent building material properties and has been widely used in constructions in the last decades in many countries (see Fig.1). Accordingly, an increase of waste gypsum in C&D waste is expected in the upcoming years. Sulfates are unwanted in other secondary building materials (particularly in recycled concrete aggregates due to the formation of Thaumasite and Ettringite) and should be minimized for quality reasons. On the other hand, used gypsum can also be used in gypsum production.

Furthermore, the actual gypsum demand in Germany is fulfilled (at least 60%) by gypsum as side product from coal-fired power plants (FGD Gypsum). Germany's natural gypsum deposits fulfil the remaining gypsum demand. Due to national climate protection goals the gypsum supply from coal power plants will decrease significantly in the future. Also available extraction areas will not be approved due to nature conservation reasons. The recycling of gypsum can be seen as a contribution in solving future gypsum demand problems. A study, supported by the German Federal Ministry for the Environment, Nature Conservation and Nuclear safety, investigated the gypsum recycling in Germany including an environmental evaluation.

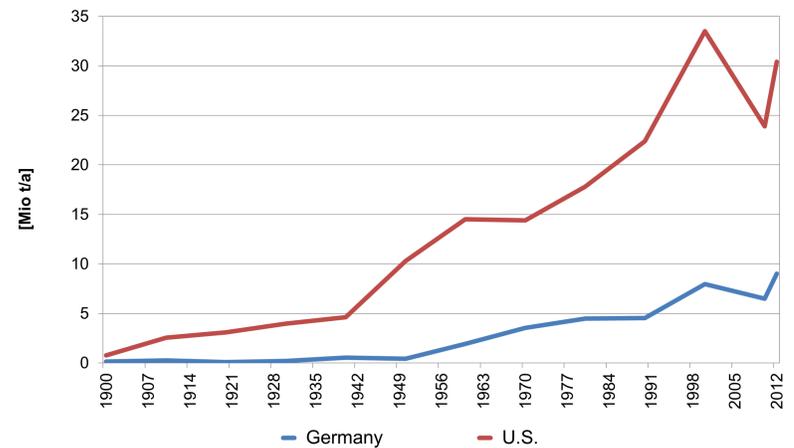


Fig. 1: Gypsum Consumption in Germany und U.S.

Usable gypsum from buildings

A large percentage of the gypsum in building is installed in form of gypsum plasterboards in interior fittings. Gypsum plasterboards are comparatively simple to remove and to separate during selective dismantling. A high sorting purity can be achieved. Figure 2 shows a prognosis for the gypsum output from buildings, based on the lifetime of gypsum and data from gypsum production.

Techniques for the recycling of gypsum plasterboards already exist and high quality standards can be achieved and significant advancements in the processing of gypsum residues in the last years have been made. Still the separate collection of used gypsum plasterboards is of special importance, because impurities affect the processing results. Also, the reuse in gypsum production has been improved in the last decade. Fig. 3 shows a simplified flowchart of the processing of used gypsum plasterboards in a stationary gypsum recycling plant.

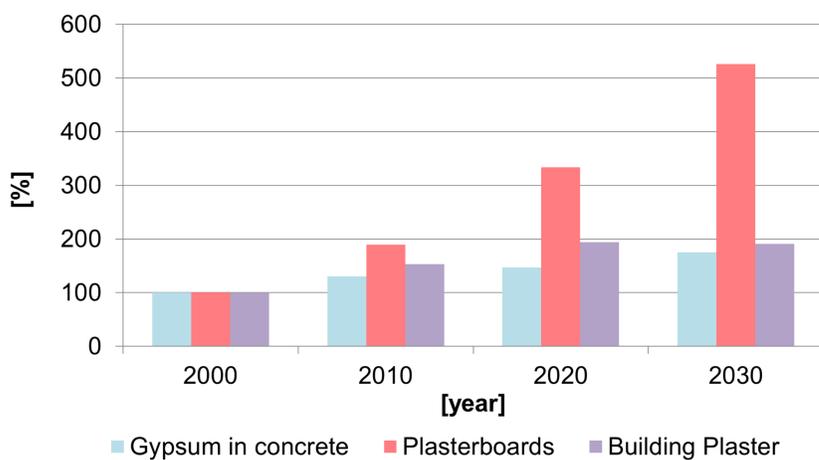


Fig. 2: Prognosis for gypsum output from buildings

Environmental evaluation

Since almost all processing steps in the recycling process are associated with environmental impacts, an environmental evaluation of the use of recycled gypsum as a substitute in gypsum production has to be carefully conducted.

Two scenarios were chosen for the recycling of gypsum plasterboards including related transports (100 km and 200 km transportation distances) and the results have been compared to available data for natural gypsum FGD gypsum (see Figure 4). The evaluation showed that the recycling of gypsum plasterboards can be also environmentally advantageous, however transportation distances are of major importance.

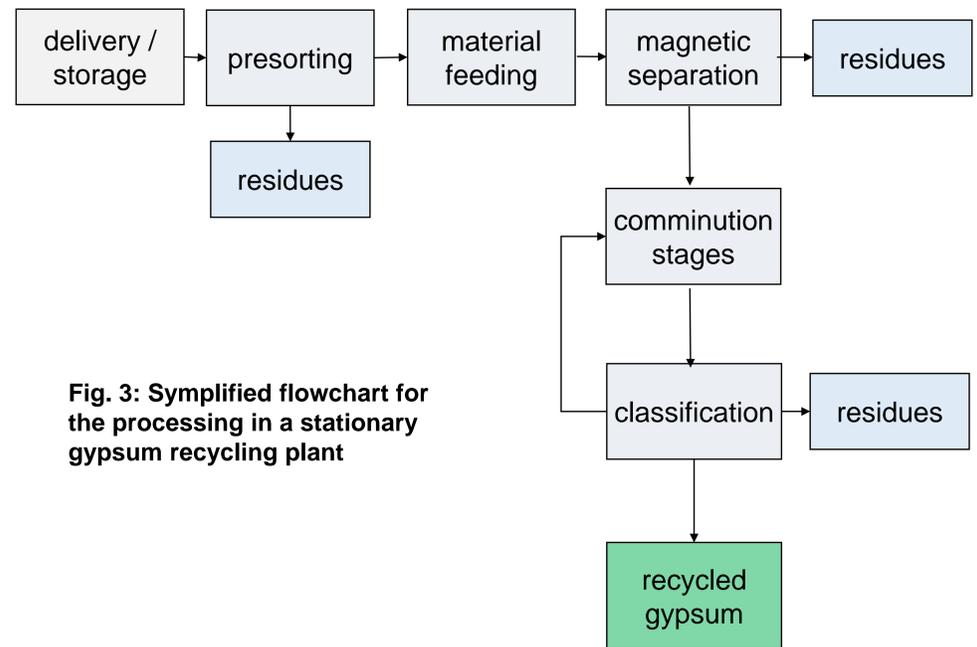


Fig. 3: Simplified flowchart for the processing in a stationary gypsum recycling plant

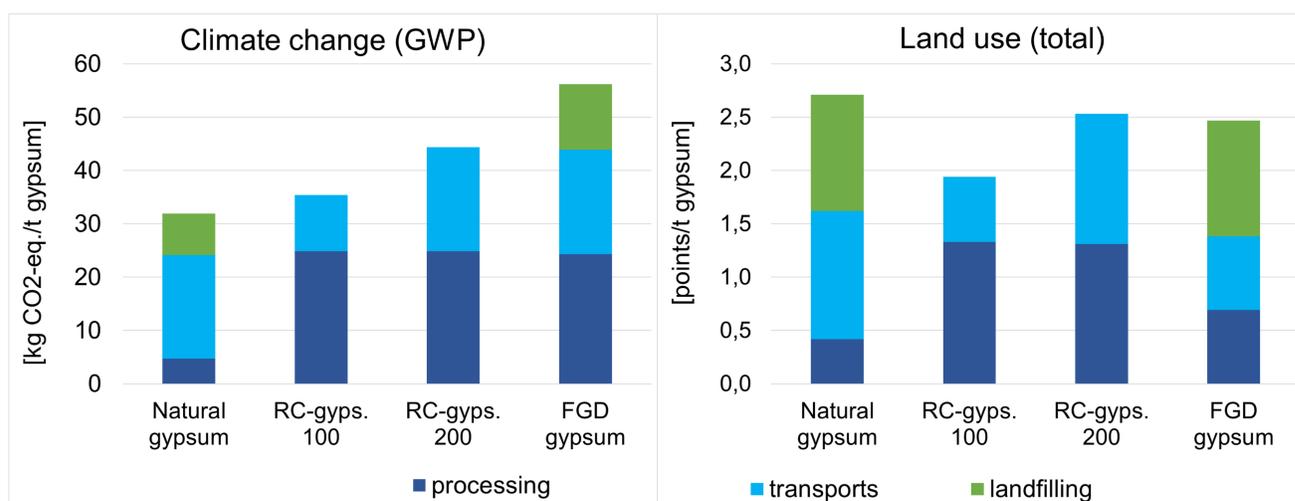


Fig. 4: Environmental evaluation: results for climate change and land use

Conclusion

The recycling of gypsum plasterboards after selective deconstruction is feasible, even the high quality requirements of the German gypsum manufacturers can be met.

Furthermore, an environmental evaluation of the whole process of gypsum plasterboard recycling and reuse showed that this approach can be environmentally advantageous. Therefore, a closed-loop recycling of gypsum plaster-boards is possible.