Recycled aggregates can be manufactured into effective green-roof growing media

Recycled wastes for green roof growing media

by CHLOE MOLINEUX, Living Roof Design

PhD research conducted at Royal Holloway University of London from 2006-2009 has shown that recycled aggregates made from waste materials, often sent to landfill, can be manufactured into effective green-roof growing media (substrates).

These substrates, supplied by Shire Green Roof Substrates, included the industry standard crushed red brick and five alternatives; crushed yellow brick, crushed aircrete blocks and three types of pellets made from: clay and sewage sludge, paper ash from recycled newspapers and carbonated limestone from waste quarry fines. Each aggregate was characterised, in particular for lightweight properties, alkalinity and water-holding capacities (*Molineux et al. 2009*), then accessed for their ability to support a variety of plant species on an experimental roof site.

Overall, results suggested that the most effective substrate for plant biodiversity varied over time but, generally, mixes containing clay pellets had increased vegetation coverage and plant-species richness. The findings of this research allowed a successful rooftop classroom to be designed for Hackney Free and Parochial School. Educational lessons were also run with two Year 8 classes (six hours per class) in order to engage pupils in the design process of their green roof and to get them thinking about biodiversity, habitat loss, sustainability, recycling and other economic issues. The overall design of the roof included four different types of recycled substrate – namely crushed red brick, yellow brick, aircrete and clay pellets – at varying depths, sand mounds for solitary bees, log piles for invertebrates and some bare cobble areas for rare spiders.

An Examination of the Thermal Performance of Green Roofs in the UK

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The thermal performance of green roofs is an area in which relatively little study has been carried out in the UK. However, it is widely assumed that they are not effective in providing insulation. This research examined the thermal performance of an intensive green roof (80mm substrate, filter fleece, 40mm drainage layer, protection fleece and PE foil slip layer) and extensive green roof (30mm sedum blanket) and assessed their thermal benefits/drawbacks in the UK winter climate. Experiments were undertaken on one-square-metre samples at the University of Bristol with funding from the EPSRC.

The results and analysis showed that intensive green roof did slightly improve the roof's thermal performance in winter when both wet and dry. However the extensive sedum blanket was demonstrated to have a slight negative influence on thermal performance. This is possibly a result of the increased albedo and the influence of evapotranspirative cooling.

Additionally the research suggested that the thermal performance of the extensive sedum blanket is more sensitive to rainfall than the deeper intensive roof. This is to be expected, as the reduced thickness of the sedum blanket means that the rainfall displaces the air in the voids which acts as insulation quicker than in the intensive roof. Both the intensive roof and extensive sedum blanket did not compare well to the performance of conventional insulation.

The apparent slight reduction in the thermal performance of the extensive sedum blanket in winter suggests that its thermal properties should not be used to justify retrofitting extensive sedum blankets on poorly insulated roofs in the UK winter climate. The intensive green roof tested did offer a small improvement in thermal performance for the UK winter climate. However, it should be noted that the thermal impacts of both intensive and extensive roofs will be further reduced in the situation where the roof had insulation and in such cases is likely to be negligible.

The experiment had a number of limitations, including its limited scope, time and number of tests completed. Further tests should be undertaken to fully confirm the findings of this work and the relationships between the thermal performance of wet and dry conditions on green roofs and the cooling effect of green roofs in the UK climate. There is an apparent need for more research in the UK climate. Further tests would benefit from large-scale trials and monitoring over the course of a year.