

## **Optimization of polyurethane panels properties through different particle and fibre reinforcement**

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### **Abstract.**

Polyurethane is a highly versatile material and depending on its structure can be applied in several application fields. One of its main applications is as insulating material for the construction sector while the most common product shape is that of the rigid expanded panel. In this work the possibility of optimizing polyurethane expanded panels for building insulating purpose is investigated by considering different particle and fibre reinforcement. Precisely, the addition of different reinforcement percentages of bentonite, phyllite, different graded talc and recycled textile microfibres (both untreated and treated with NaOH) is considered in polyurethane mixes. For fibre reinforced samples, castor oil is additionally considered as a more sustainable polyol component in polyurethane mix, which is composed by isocyanate, polyol, water, silane additive and catalysers. Thermal conductivity is positively reduced by increasing phyllite content, indeed these microspheres further apport porosity to the material, so a lower density, and promote a homogeneous, fine and closed porosity. Besides, both castor oil and NaOH fibre treatment enhance the thermal insulating too. Since insulating materials might find application also in structural elements, creep and compression test are also performed. Polyurethanes containing phyllite and talc display greater stiffness and mechanical improvements for specific ranges of particle percentage. On the other hand, fibre reinforcement exceeds the particle one by an order of magnitude in improving mechanical properties both in term of maximum load and recovery. In conclusion, polyurethane reinforcement and alternative polyols are valuable solutions toward more sustainable and performant insulating building panels and product differentiation.