

ZERO CO₂ WASTE WOOD CONCRETE WITH MECALITHE®

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ABSTRACT

Serious challenges posed by global warming due to atmospheric emission greenhouse gas CO₂ and seeing that 1.47 kg of CO₂ can be compensated by 1 kg of wood have induced a trigger. This study is directed to produce professional tiles at operational level for additional advantages over traditional tiles. Concrete samples were tested and achieved CS of 22.40 N/mm², BS of 5.50 N/mm² in 28 days. The density ranged between 1.362-1.803 kg/m³, Freeze-Thaw is 0.30 kg/m², Abrasion Test is 19 mm and demolding with-in 24 hours under an operational set-up. The calculated CO₂ compensation for used waste wood concrete was at (-) 84.82 kg/m³

INTRODUCTION

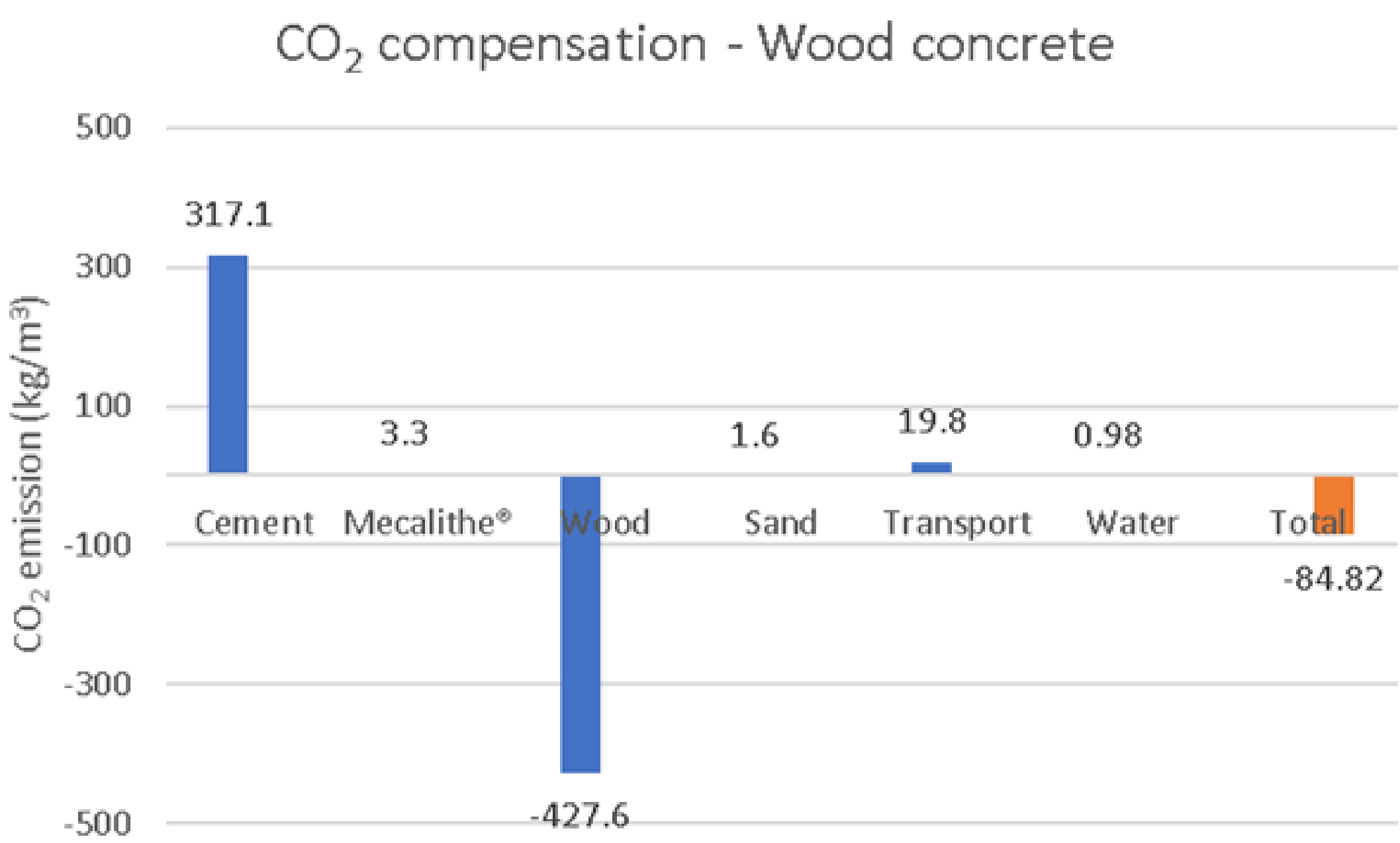
Global warming in this century is likely to be between 1.0 and 3.7 °C, greenhouse gas CO₂ emission has significantly influenced this. The use of waste wood (replacing traditional sand and gravel) in the production of concrete can be of great value in achieving CO₂ compensation. Typically 1 m³ of beech wood (= 720 kg) contains 1,058 kg CO₂, which is 1.47 kg of CO₂ /kg wood^{2,3}. This study leads to the production of zero-carbon, eco-friendly, light weight, green waste wood concrete through Mecalithe® Technology. This is produced both at lab level and operational levels. CS - N/mm², BS -N/mm² (tested at 3, 7 and 28 days), Density kg/m³, air (%) and related observations are the basis of the quality evaluation of produced waste wood concrete. Compressive and bending strength (N/mm²) conforms to NEN-EN 12390-3:2009 and NEN-EN 12390-5:2009 respectively.

METHODS AND MATERIALS

Waste wood was obtained locally. The concrete was produced in 2 stages (1) granulates; (2) final waste wood concrete. Cement (CEM I 52.5R), waste wood (0 - 2 mm particle size), Mecalithe® 20/14 powder, Mecalithe® additive, 0 – 2/4 mm sand were mixed suitably to produce granulates. The final concrete was produced using these granulates (60%) with 285 kg/m³ of CEM I 52.5R, 40% sand (0-2/4mm), both at lab and operational level.

RESULTS AND DISCUSSION

The produced waste wood concrete had a significantly high CS of 22.40 N/mm², BS of 5.50 N/mm² in 28 days with a density range of 1.362-1.803 kg/m³. The CO₂ emission analysis shows that the final status of CO₂ compensation is (-) 84.82 kg/m³. Freeze-Thaw was 0.30 kg/m², Abrasion Test is 19 mm and demolding was successfully achieved with-in 24 hours Overall testing results indicate an excellent quality of the innovative concrete product. Tiles made with waste wood concrete with these results are comparable with tiles made up of traditional sand and gravel. The waste wood tiles also have an additional advantage of being light weight, eco-friendly green concrete and save CO₂ emission, as a big bonus.



	3 days	7 days	28 days
Compressive Strength (N/mm ²)	16.08	19.24	22.40
Bending Strength (N/mm ²)	4.97	5.04	5.58
Density (kg/m ³)	1,361-1,803 (wet)		

REFERENCES

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CONCLUSIONS

1. Traditional sand and gravel is replaced by 45 % pre-processed waste wood (granulate) in the production of green-concrete using Mecalithe® Technology.
2. A CS of 22.40 N/mm² and BS of 5.58 N/mm² in 28 days are achieved. The density ranged from 1,361 – 1,803 kg/m³. The CO₂ emission compensation is calculated at (-) 84.82 kg/m³. Freeze-Thaw is 0.30 kg/m² and Abrasion Test is 19mm, indicating an excellent quality of the innovative concrete product. Produced successfully at operational level. More studies needed to understand chemical dynamics at molecular level.