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Using of wheat straw as natural reinforcement of earth plaster for straw bale buildings

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Natural earth plasters are experiencing a renaissance in sustainable building. Earth plasters may fulfill many functions in straw bale wall system, such as protecting the underlying surface, enhancing or preventing the migration of vapor or liquid moisture, mitigating the migration of air currents and carrying structural loads. Earthen plasters incorporating chopped straw are commonly used in the construction of straw bale walls because the straw provides tensile strength and is readily available. Earth plaster usually comprises three components, namely binder, aggregate and reinforcement. On the other hand, faced with the worldwide shortage of forest resources, the construction industry is showing interest in the production of particleboard from agricultural residues. In this research work three materials are used in our tests, i.e. cohesive soil, sand and reinforcement fibres. The composition of the cohesive soil texture is as follows: 31% clay (<2 mm), 22% silt (20-63 mm) and 47% sand (63-2000 mm). The wheat straw particle length of straw was about 5cm. The mixing ratios for wheat straw fibres were 0, 25, 50 and 75%. An extensive test program was carried out for earth plaster reinforced with wheat straw fibres. The experimental work includes compression tests, thermal conductivity, erosion, shrinkage and equilibrium moisture content. The average of compressive strength of earth plaster reinforced with wheat straw fibres are 0.824, 0.819, 0.795 and 0.329 MPa for reinforcement fibers percentages 75, 50, 25 and 0 % respectively. The averages of thermal conductivity are 0.1945, 0.2719, 0.3347 and 0.3498 W/mK for reinforcement fibers percentages 75, 50, 25 and 0 % respectively. On the other hand, the averages of erosion rates are 0.11, 0.67, 0.75 and 12 cm/hr for reinforcement fibers percentages 75, 50, 25 and 0 % respectively.