

## Utilization of aquatic weeds fibers for handmade papermaking

### ABSTRACT

Increasing global paper consumption has fostered the search for new alternative non-wood fiber sources. The aquatic weeds *Cyperus digitatus*, *Cyperus iria*, and *Scirpus grossus* were analysed for their fiber characteristics and chemical composition, and the processed fibers were transformed into handmade paper. The selected species yielded medium-length fibers (0.92 mm to 1.03 mm), which were thin-walled with a lumen diameter (3.37  $\mu\text{m}$  to 5.26  $\mu\text{m}$ ) wider than cell wall thickness (2.73  $\mu\text{m}$  to 2.97  $\mu\text{m}$ ). In terms of fiber derived values, the selected species possessed a slenderness ratio of 86.5 to 113.1 (favourable, > 30) and flexibility coefficient of 35.2 to 47.6 (favourable, within the range 50 to 70), which was classified as rigid fiber. The species also contained high cellulose, 42.1% to 44.8% (favourable, > 40%) and hemicellulose content, 42.8% to 45.6% (favourable, within the range of 30% to 50%), and low lignin content, 10.6% to 11.8% (favourable, < 12%). Handmade paper of *Cyperus digitatus* possessed relatively high tensile strength ( $2.61 \pm 0.15$  kN/m) and breaking length ( $1.20 \pm 0.07$  km) among studied species. Comparison with other non-wood fibers indicated that the studied plants fibers can be used for production of paper plates, paperboard, and decorative paper.

**Keyword:** Aquatic weeds; Fiber; Handmade papermaking