Investigating Circadian Rhythmicity and Growth Phenotype in Neurospora intermedia to Utilize Industrial Food Waste

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Filamentous fungi offer promising solutions for upcycling industrial food byproducts. Neurospora intermedia, used for centuries in Western Java to ferment red oncom from a byproduct of soy milk production, is a strong candidate for large-scale applications because it efficiently breaks down indigestible fibers into nutrient-rich, edible forms through solid-state fermentation. Still, its circadian clock and responses to light cues remain understudied, even though these traits directly affect growth behavior in industrial fermentation. This study investigated whether N. intermedia exhibits a self-sustaining circadian rhythm and how environmental conditions and media composition influence its growth. Circadian rhythmicity was evaluated from conidial (asexual spore) banding patterns, and BLASTp-based computational analysis assessed conservation of core clock proteins between N. intermedia and the model organism N. crassa. On both soy-pulp-based and synthetic media, N. intermedia displayed strong growth phenotypes, including rapid and uniform growth and clear responses to light cues. In optimized trials, cultures held in constant light and then shifted to constant darkness for three days showed evidence of a self-sustaining circadian rhythm. The homolog comparisons showed high sequence identity for key circadian proteins that constitute the genetic framework of a circadian clock. These genotypic and phenotypic data indicate that N. intermedia retains a functional circadian system and is a candidate for rhythm-informed, low-waste fermentations on byproducts such as soy pulp that can improve energy and nutrient efficiency while helping address food waste and food insecurity.

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