

Commercialization Plan

The commercialization of the technology is expected to proceed in different phases as highlighted below:

Phase 1:

Technology Readiness Advancement: The research will proceed from TRL 3–4 (lab validation) where it is currently to **TRL 5–6** (pilot demonstration) through machine fabrication and pilot-scale testing. At the completion of the pilot demonstration stage, **demonstration runs will be carried out with small and medium scale enterprises, cooperatives, and textile industries** to validate performance in real-world settings.

Phase II

Market Entry Strategy: Priority market segment like textile industries (eco-friendly fabrics), artisans/handloom sector, eco-conscious fashion brands, paper/packaging, cosmetics, and food-grade colorants and pharmaceutical industries will be identified. Thereafter, **product prototypes** like (standardized dye powders, pastes, or concentrates) for will be develop for sampling and feedback. **Certifications processes** (eco-labels, toxicity-free compliance) will be initiated to enhance market credibility.

Phase III

License of the extraction process and machine design to SMEs and cooperatives will be carried out. The rural community will also be trained through workshops to operate small-scale extraction units with a means of linking them to industrial buyers.

Phase IV

Protection of intellectual property and branding will be carried out by filling for patents and developing sustainable-focused brand identity to differentiate other product in the market