

IIT MADRAS Technology Transfer Office TTO - IPM Cell



Industrial Consultancy & Sponsored Research (IC&SR)

WASHING MACHINE WITH RINSE WATER TREATMENT AND REUSE **IITM Technology Available for Licensing**

Problem Statement

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- It is noted that washing machine is commonly used in households, which consumes up to 120L of water, & by reusing and treating the wash/waste water, one can reduce the fresh water demand by 30-70%.
- In the prior art, there is some literature about a few technologies which do not provide solution like removina complete the turbidity & suspended matter from wash water and addrressing improper chemical & biological quality in wash water.
- Hence, there is a requirement to introduce an **apparatus** to mitigate above challenges & provide new sustainable efficient solution.
- Present invention provides the solution of appropriate **reuse** of wash water & mitigate the use of fresh water in washing machine.

Technology Category/Market

Technology: Rinse water treatment apparatus integrated with washing machine;

Industry: Home Appliances;

Water Applications: treatment & reuse/recycling of water in washing machine; Market: The global washing machine market size is valued USD 59.39B in 2023 & projected to be valued \$83.47B by 2030, at a CAGR of 4.98% during forecast period (2023-2030).

Intellectual Property

IITM IDF Ref.: 1293; Patent No: 441978

Technology

- Present invention describes а washing machine for clothes configured to reuse water & integrated with a rinse water treatment apparatus. (Refer Fig. 1 & 2).
- apparatus comprises storage tank Said provided with an agitator.
- Further, said storage tank comprises:
- 1. A treatment module for storing & injecting a flocculating agent, a coagulating agent or a disinfecting agent into the storage tank.

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2. One or more water quality sensors affixed to the storage tank, for assessing the quality of treated water and one or more level sensor.

Further, said apparatus comprising a **control** system which monitors the function of treatment module to inject at least one the flocculating agent, coagulating agent and **disinfecting** agent into the storage tank in a predetermined sequences & quantities .

Rinse Water Treatment Apparatus



Illustrates block diagram Fig.1: of а washing machine configured to reuse water and integrated with a rinse water treatment apparatus.

Reference Nos listed herein:

100: rinse water treatment apparatus; 101: storage tank; 104: treatment module; 105: control system 120, 130: 3 way valve; 140: Pump; 150: Level sensor;

160, 161: water quality sensor(s);

TRL (Technology Readiness Level)

TRL- 4, Proof of Concept & validated

Research Lab

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Technology Images Experimental Results- Table 1 **Characteristics of Treated water** Fig.2: Illustrates components of an (washed water) apparatus for washing machine rinse water treatment Parameters Turbidity FC (CFU/ 100mL) (NTU) AI C P ₽₽₽ Rinse 1 21.4 4 Rinse 2 4.29 Nil Fresh $\overline{}$ D Pump water Micro Filter 3-way 🖾 Valve **Rinse 3** 2.35 Nil Water In LS Float Standard <5 Nil ٥A Control Unit Limit for ऱ (WRA) reuse Wash Drum Agitator Pump Water Out Π Various treatment trails can be used for 必 Ð kk⊨ 3-wav treating the wash water to achieve the Washing Machine Valve Caogulation Unit Drain water quality required for reusing the water. (Experimental result shown in Water Recycling Apparatus (WRA) Table) **FIG. 2**

Key Features / Value Proposition

* Technical Perspective

- 1. Proposed system includes the control system which is characterized by causing the treatment module to inject requisite one of the flocculating agent, the coagulating agent and disinfecting agent into the storage tank in a predetermined sequence and quantities determined based on a turbidity or fecal contamination level of the water based on the input received from the water quality sensor, to produce treated water. (Refer Process flowchart shown in Fig. 3)
- 2. The chemical treatment method includes coagulation, flocculation, disinfection followed by micro filtration, which makes the apparatus a fully automated control system.

* Industrial Perspective

1. **Cost-effective & user-friendly** apparatus; & applicable to any **brand** washing machines.

* <u>User Perspective</u>

- 1. Efficiently **reuse** of the **treated wash/rinse water** from washing machine.
- 2. Reduces demand for fresh/soft water and avoids the use of hard water.

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Functional Flowchart



Typical Application of Technology

- Storage tank for treated water is at the base of the machine.
- Treated water, to the extent available in \triangleright storage tank, is used for the wash cycle. Fresh water is used to top up as needed.
- \triangleright Wash water is discharged in the drain.
- \geq Treated water, to the extent available in storage tank, is used for **first rinse cycle**.
- Rinse water is discharged into (mostly empty) \geq storage tank and treated in situ.
- \triangleright Fresh water is let in for Second (final) Rinse cycle.
- Rinse 2 water is discharged into storage tank \triangleright and treated.
- Occasionally, **storage tank** can be flushed out \triangleright to drain to **remove the coagulated matter**.

FIG. 3

Benefits

- We need only 33% fresh water \triangleright with the remaining being treated water.
- \geq Where soft water supply is limited and ground water is hard, limited requirement of soft water can improve wash quality.
- \triangleright A **60L tank** at the base of the machine should be sufficient. Many users use a stand to raise the machine. Instead the storage tank can serve this purpose as well.
- \triangleright The water saver mode and **storage tank** can be designed as an optional feature.

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