



Industrial Consultancy & Sponsored Research (IC&SR)

Cellulosic Particles Based One-component Polyurethane Adhesive and Method of Preparing the Same

IITM Technology Available for Licensing

Problem Statement & Unmet Need

- Nowadays **adhesive structural bonding** has become a **bigger** alternative to welding and brazing in industries.
- The adhesive should **wet** the **adherents surface** before it cures to achieve good adhesion, making accelerated curing with properties necessary to get the **desired properties**.
- The **one component moisture curable adhesives** take more time to achieve handling strength due to which longer **fixation times** are required after the installation for the joints to develop handling strength without **slipping**.
- By the **artificial addition** of moisture/hydroxyl groups (or both), the low curing rate is reduced by **accelerated curing rate** and **reduced fixation time** significantly.
- Therefore, there is a need for **improved cellulosic particle-based one-component polyurethane adhesive** wherein the cellulosic particles act as relative fillers and moisture reservoirs for **enhancing the curing rate** and addressing the mentioned issues.

Technology Category/ Market

Chemical Technology- Manufacturing, Advanced Materials, Automates;

Industry- Aerospace; Automotive Industry; Polymer Science,

Applications: joining **dissimilar materials** like in cars for joining **steel frame to glass** windshield, and in buses to join the **aluminum to steel side skirts**, steel to side glass windows, and for **bonding the windshields**.

Market- The global polyurethane adhesives market was valued at USD **8.1 billion** in 2022 and is projected to reach **USD 10.3 billion by 2027**, growing at a cagr **5.0%** from 2022 to 2027

Technology

- Present Patent literature discloses a method for preparing **cellulosic** particle-based one-component polyurethane adhesive material. The method comprises the steps of:
- pre-heating one-component polyurethane adhesive (PU) at 800 C for 2-3 hours;
- pre-heating the filter material (either **Microcrystalline Cellulose (MCC)** or **Saw Dust (SD)**) that acts as a reactive filter and moisture reservoir.
- The filter material is **well dispersed** in the **PU adhesive** results in quick consumption of **isocyanates**, thereby reinforced polyurethane bonded joints showed improved **lap-shear strength** with **little strain reduction**.

A graphical representation of the **lap shear configuration** of the cellulosic particle based one-component polyurethane adhesive is shown in **FIG 1**, and shapes of **microcrystalline cellulose & sawdust powder** particles with **insets** are shown the **particle size distribution** respectively is shown in **FIG 2**.

Method:

The **method** for preparing the Cellulosic Particles Based One-component Polyurethane Adhesive **PU adhesive** is given in the following steps:

- Pre-heating one-component polyurethane adhesive (PU) at 800 C for 2-3 hours to facilitate thorough mixing of at least one filler material (MCC and SD).
- Pre-heating the filler material at 800 C for 3 hours.
- The one-component polyurethane adhesive (PU) is manually mixed with the filler material (Microcrystalline Cellulose (MCC) and Saw Dust (SD)) for 2 minutes in order obtain enhanced curing rate of moisture curable one-component polyurethane adhesive.

Intellectual Property

IITM IDF Ref: 1896
IN Patent No. 399962 (Granted)

Key Features / Value Proposition

- Polyurethane (PU) adhesives are widely used to **join materials** that have a **high coefficient of thermal expansion** mismatches such as dissimilar metals, **glass fiber-reinforced plastics (GFRP)**, and **glass panels**.
- It has a **good load-bearing capacity, design flexibility, uniform stress distribution, and good low-temperature properties**. Hence, they are used as both **adhesives** and **sealants**.
- The filler material and adhesive material can significantly reduce the **overall fabrication time** and **greatly simplify the shop floor logistics**.

TRL (Technology Readiness Level)

TRL-5 Components validation in relevant Environment

Research Lab

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Images

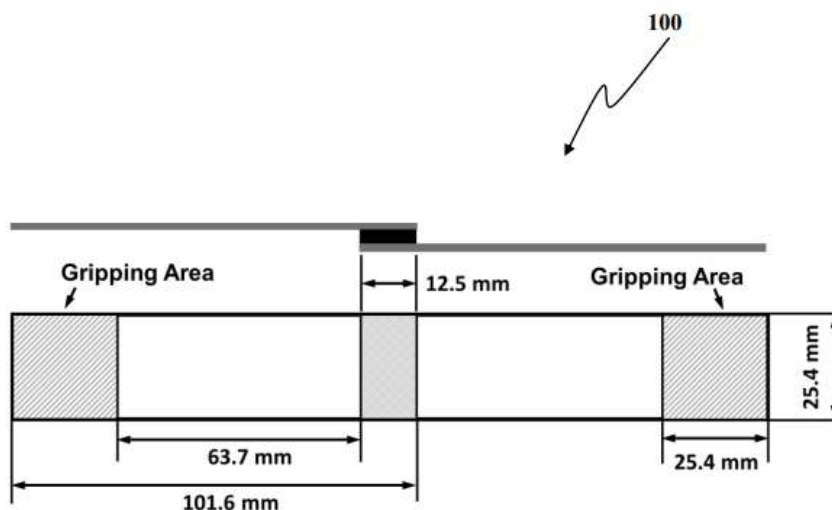


FIG 1

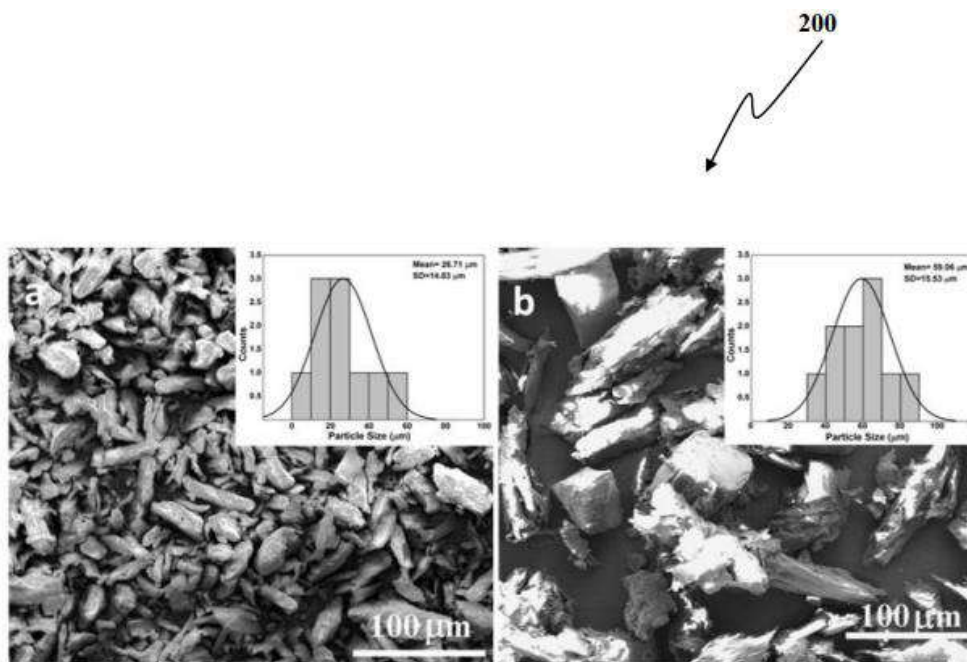


FIG 2

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