# The Influence of Redispersible Polymer Powder on the Performance of Permeable Mortar

**Abstract:**
By incorporating redispersible latex powder during the preparation of permeable mortar, this study investigates the effects of varying dosages on workability, mechanical properties, permeability, and wear resistance. Results indicate that redispersible latex powder significantly enhances workability, compressive strength, flexural strength, and wear resistance of permeable mortar, while exerting minimal influence on its permeability coefficient. The optimal performance is achieved at a 2.0% dosage of redispersible latex powder.
**Keywords:** Redispersible latex powder; permeability; flexural strength; wear resistance

## 1. Introduction

Permeable mortar, a cement-based material with fine aggregates as skeletal support, hardens into a porous structure after mixing with water and admixtures. Its excellent air/water permeability contributes to noise reduction, groundwater conservation, and urban ecological improvement, making it essential for China's "sponge city" initiatives. However, narrow particle gradation and weak interfacial bonding between aggregates and cementitious materials result in low strength, instability, and poor durability, limiting large-scale applications. Enhancing mechanical properties without compromising permeability remains a critical research focus [2–3].

Polymer additives like redispersible latex powder have proven effective in improving aggregate-cement bonding and mortar performance [4]. Despite progress, key challenges persist, especially with the implementation of JC/T 2727-2022 *Permeable Mortar*, which standardizes performance metrics.

This study evaluates the impact of redispersible latex powder on workability, mechanical properties, permeability, and wear resistance, providing practical references for production and application.

## 2. Materials and Methods

### 2.1 Materials

- **Cement:** P·O 42.5 ordinary Portland cement (Jidong Cement), properties listed in Table 1.
- **Fine aggregate:** 1–3 mm river sand.
- **Water:** Tap water.
- **Superplasticizer:** Polycarboxylate-based (28.5% water reduction rate).
- **Redispersible latex powder:** Powder form.

**Table 1. Basic properties of cement**

| Standard consistency water demand (%) | Initial setting (min) | Final setting (min) | Compressive strength (MPa) | Flexural strength (MPa) |
|---|---|---|---|---|
| 28.2 | 145 | 195 | 3d: 29.8; 28d: 54.6 | 3d: 5.8; 28d: 9.2 |

### 2.2 Mix Proportions

The baseline mix is shown in Table 2. Redispersible latex powder was added at 0%, 0.5%, 1.0%, 1.5%, 2.0%, 2.5%, and 3.0% of cementitious material weight. Specimen preparation followed JC/T 2727-2022.

**Table 2. Baseline mix proportions (kg/m³)**

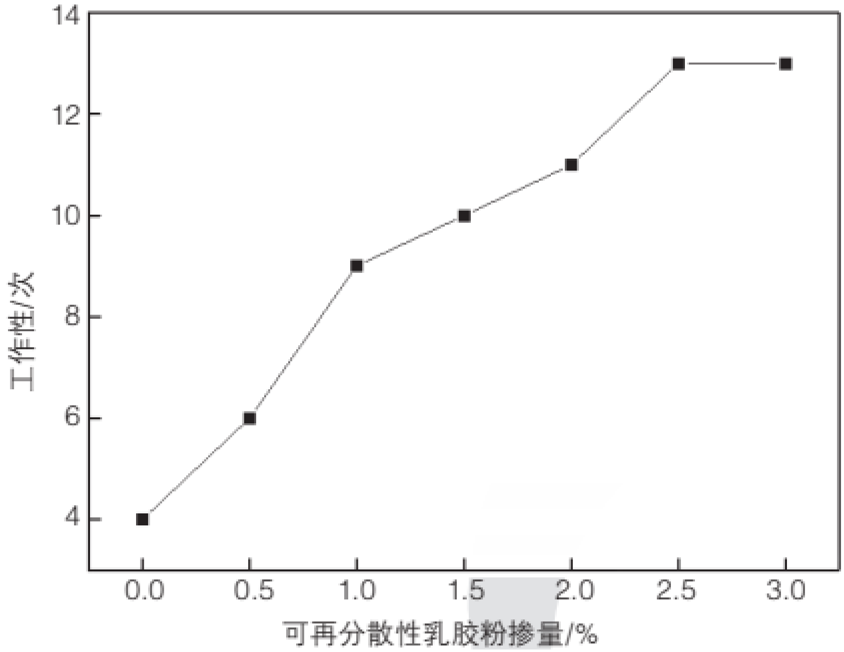
| Cement | Fine aggregate | Water | Superplasticizer |
|---|---|---|---|
| 365 | 1600 | 110 | 7 |

### 2.3 Test Methods

- **Compressive strength:** JGJ/T 70-2009 *Standard for test methods of basic properties of construction mortar*.
- **Flexural strength:** GB/T 17671-2021 *Test method for cement mortar strength (ISO method)*.
- **Wear resistance:** GB/T 12988-2009 *Test method for abrasion resistance of inorganic floor materials*.
- **Workability & permeability coefficient:** JC/T 2727-2022 *Permeable Mortar*.

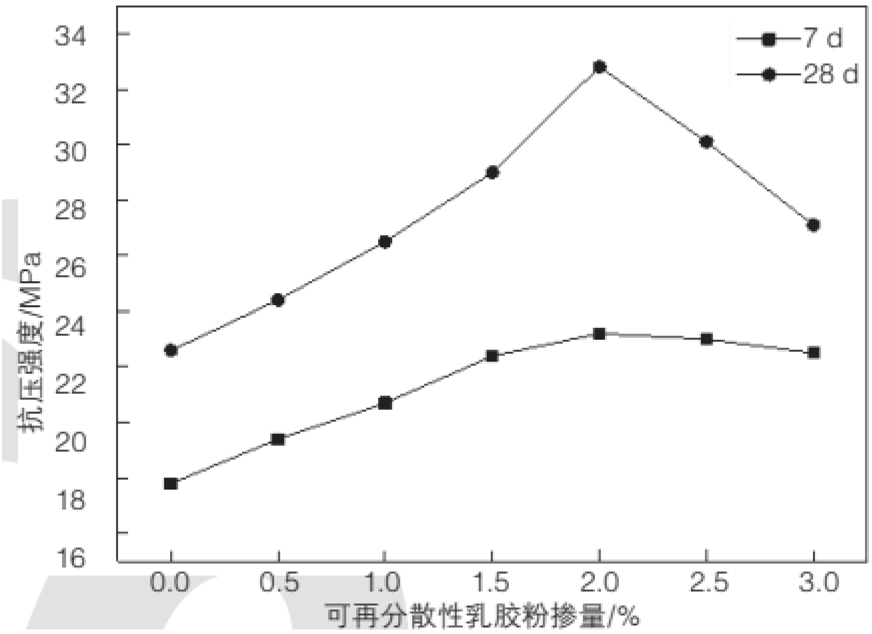
## 3. Results and Discussion

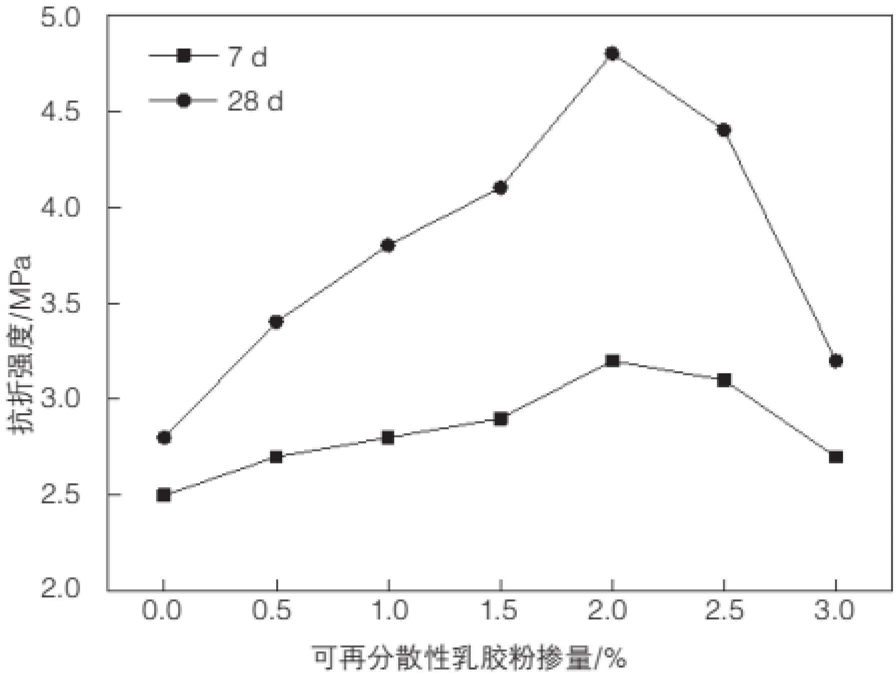
### 3.1 Workability




Workability improved with increasing latex powder content (Table 3, Figure 1). The powder enhanced slurry viscosity and uniform aggregate coating, boosting cohesion [5].

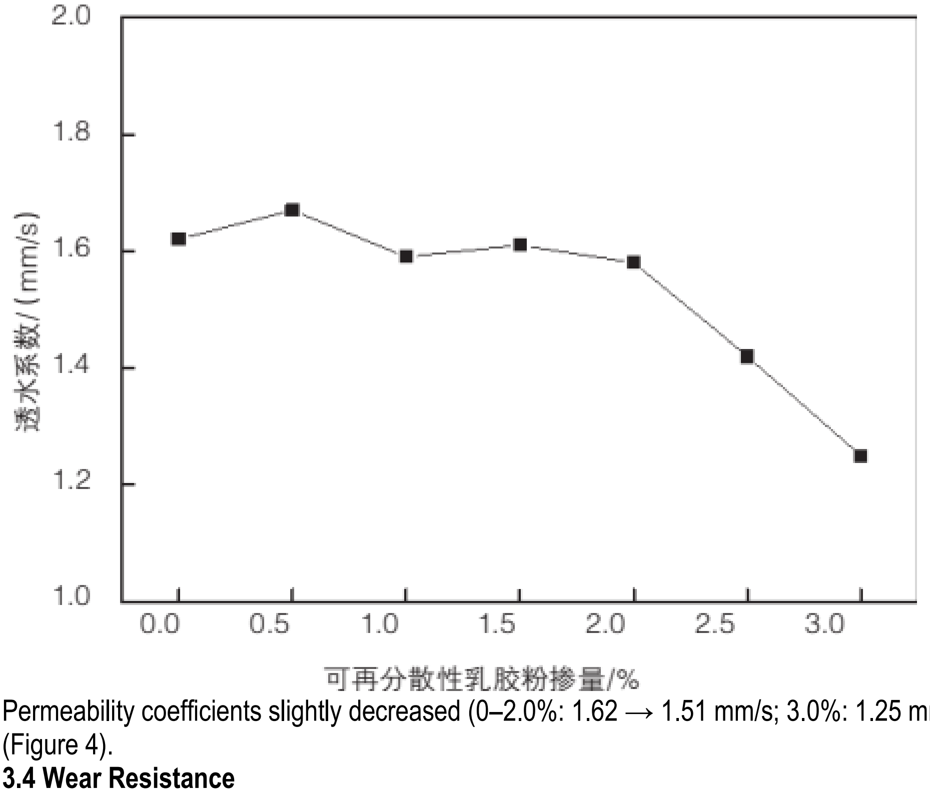
**3.2 Mechanical Properties**





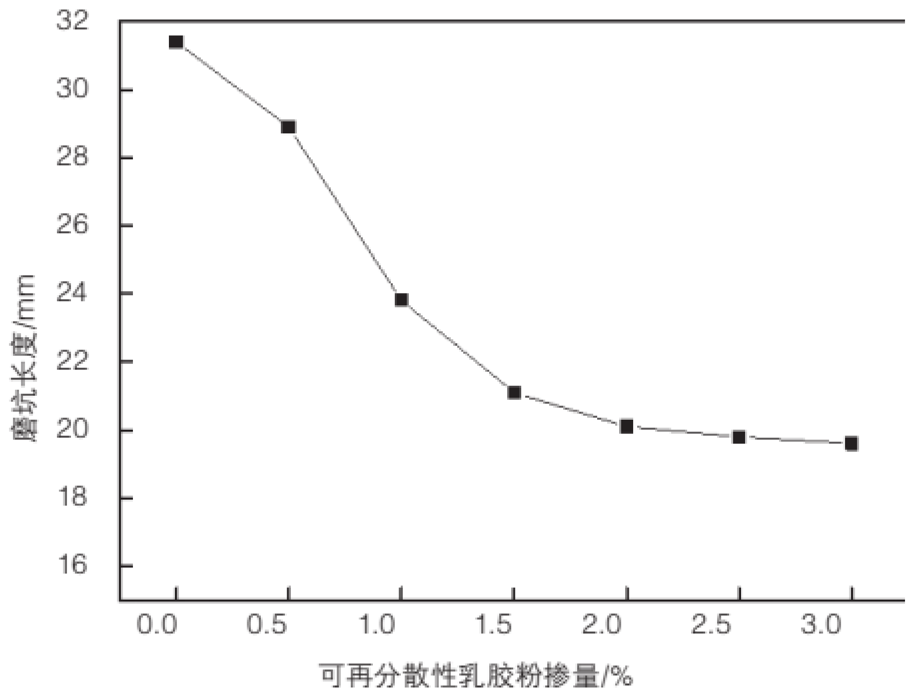

Both compressive and flexural strengths peaked at 2.0% dosage (7d: 26.2 MPa, 3.4 MPa; 28d: 32.8 MPa, 4.8 MPa). Latex powder initially delayed cement hydration but later formed a reinforcing polymer network at interfacial transition zones [6]. Excess dosage (>2.0%) introduced air voids, weakening bonding.

**3.3 Permeability**




Permeability coefficients slightly decreased (0–2.0%: 1.62 → 1.51 mm/s; 3.0%: 1.25 mm/s) due to pore clogging at higher dosages (Figure 4).

**3.4 Wear Resistance**




Abrasion pit length reduced with latex powder addition, plateauing beyond 2.0% (Figure 5), aligning with strength trends.

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**4. Conclusions**

1. Workability improved continuously with latex powder dosage.
2. Mechanical properties peaked at 2.0% dosage (28d compressive: 32.8 MPa; flexural: 4.8 MPa).
3. Wear resistance enhanced but stabilized above 2.0%.
4. Permeability coefficients marginally declined (max Δ = 0.37 mm/s).

**Optimal dosage:** 2.0% redispersible latex powder.

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**References**

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*Note: All figures and tables are retained as per the original document, with captions translated accordingly.*