45S5 Immersion: Explain a pH Spike

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Abstract. Interpret a 45S5 pH rise in the context of glass dose, exposed surface and medium buffering. This note outlines controlled comparisons and supporting measurements. The observed pH belongs to the full test system and cannot be assigned to glass identity alone.

Keywords: 45S5; immersion; pH; buffering; exposed surface

1. Normalize the exposure

An in vitro comparison of 45S5 and 58S found that dissolution behavior depended on particle size and medium; smaller particles increased dissolution rates under the tested conditions [1]. A result obtained in one medium cannot automatically be transferred to another.

Start with mass per medium volume, then add surface-area information where available. Illustrative calculation: 0.10 g powder in 10 mL is 10 g/L. If BET area is 1.0 m^2/g, nominal gas-accessible area per liquid volume is 10 m^2/L. A second powder at 5.0 m^2/g gives 50 m^2/L at the same mass dose.

BET area is not necessarily the area accessible in the chosen liquid, but the calculation reveals why equal powder masses may create unequal exposure. For bulk or composite specimens, also record the exposed geometry and whether a polymer covers the particles.

2. Locate the early transient

2.1 Sample early enough. Include an early time point before the usual daily endpoint if the initial response is the concern. Use a suitable calibrated pH method and consistent temperature. Opening a buffered vessel or changing gas exchange can change the measurement environment, so keep handling matched.

2.2 Pair pH with solution chemistry. Measure relevant dissolved elements and examine the recovered surface when mineral deposition is suspected. A plateau in solution calcium may reflect both release and removal into a new solid. It is not sufficient evidence that the glass has stopped reacting.

2.3 Test the intended processed form. If the glass will be embedded in a polymer or incorporated into a cement, repeat the exposure on that form. A loose-powder screen can identify a dose effect but cannot establish the initial accessibility or pH behavior of the final composite.

3. Development decision

If reducing dose or exposed area moderates the transient, evaluate that change alongside the required material function. Do not neutralize the medium by an unrecorded adjustment and compare it with an untreated control as though the exposures were identical.

Table 1. Development comparison and interpretation controls.

Proposed comparison	Keep constant	Question answered
Medium blank	Vessel and incubation	Background pH drift
Two mass doses	Powder lot and medium	Dose sensitivity
Two size fractions	Chemistry and mass dose	Size-related exposure
Two media	Dose, geometry and temperature	Buffering and medium effect

Scope. No universal acceptable pH window is specified here. Relate exposure conditions and interpretation to the intended application and its validated test framework.

References

1. Sepulveda P, Jones JR, Hench LL. In vitro dissolution of melt-derived 45S5 and sol-gel derived 58S bioactive glasses. J Biomed Mater Res. 2002;61(2):301-311. doi:10.1002/jbm.10207.

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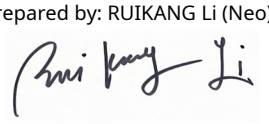

Reviewed by: Alex | Technical content: Approved

Review date: