A summary of these applied domain constraints and corresponding violation rates is presented in Table 4.

Table 4. Domain-Informed Constraints and Violation Rates for Generated Coating Compositions

Constraint Type	Parameter Material	Scientific Basis	Constraint Applied	Observed Violation Rate (%)
Toxicity Thresholds	AgNPs	Cytotoxicity above 0.1 wt% reported in mammalian cell assays	AgNPs ≤ 0.10	1.2
	ZnO	ROS generation increases above 0.2 wt%	ZnO ≤ 0.20	1.0
	PEG	Excess hydrophilicity alters surface integrity	PEG ≤ 0.25	0.6
Degradability Window	Collagen Peptides / PCL	Ensures resorption within 60 days under physiological conditions	$0.2 \leq$ polymer fraction ≤ 0.6	0.8
Mechanical Compatibility	Composite Elastic Modulus	Target modulus of 0.5-1.2 GPa for soft-tissue coatings	$0.5 \leq E\_pred \leq 1.2$ Gpa	0.5
Solubility& Dispersion Stability	HA / Chitosan	Avoids precipitation and phase separation	Conc. ≤ 0.5 mg/mL	0.4
Overall Feasibility	-	Violation of any single constraint above	-	3.2