Humimic SimuGel™ Technical Documentation

SimuGel™ is Humimic Medical's proprietary synthetic tissue-mimicking medium. It was developed to replicate human tissue for realistic medical training, trauma preparation, and device testing.

This documentation describes SimuGel™ properties, technical specifications, and applications across medical training, first responder preparation, and biotech R&D environments.

II. What is SimuGel™

SimuGel is a synthetic material designed to look, feel, and respond like human soft tissue. It provides a safe, shelf-stable, and repeatable option for clinical education, tactical training, and R&D testing.

Core Properties

- **Realistic feel**: Replicates human tissue density and response.
- **Reusable**: Built to handle repeated training and testing sessions.
- **Remoldable**: Can be reshaped for custom models and applications.
- **Safe and synthetic**: Free of biological material, reducing handling and disposal risks.
- **Shelf-stable**: Long-lasting without refrigeration or preservatives.
- **Ultrasound compatible:** Crystal-clear material provides superior ultrasound imaging capabilities with acoustic properties closely matching human soft tissue.

III. Technical Specifications & Acoustic Data

Humimic SimuGel™ 0–5 — Technical Specification & Acoustic Data Sheet

(For medical simulation, ultrasound imaging, and device testing applications)

Humimic SimuGel™ is a synthetic tissue-mimicking material engineered to replicate both the mechanical feel and acoustic behavior of human soft tissue. Each formulation (SimuGel™ 0–5) is calibrated for specific tissue analogs and validated using mechanical compression, needle puncture testing, and ultrasonic characterization.

Table 1. Product Overview – Functional Realism Scale

SimuGel™ offers six distinct formulations spanning the full spectrum of human soft tissue density. This table helps you identify which gel formulation best matches your specific training scenario, imaging application, or device testing requirements.

Gel Type	Relative Density / Realism	Typical Use Cases	Tissue Analog	Color Options
Gel 0	Standard tissue realism (baseline)	General-purpose models, procedural & imaging training	Composite soft tissue	Clear or tinted
Gel 1	Slightly denser muscle realism	Muscle layers, biopsy practice	Dense muscle / fibrotic tissue	Clear or tinted
Gel 2	Moderate density	Skeletal muscle, kidney	Muscle/kidney tissue	Clear or tinted
Gel 3	Soft organ realism	Organ phantoms, ultrasound imaging	Liver, organ parenchyma	Clear or tinted
Gel 4	Very soft	Adipose, subcutaneous layers	Adipose tissue	Clear or tinted
Gel 5	Softest formulation	Neonatal models, high-compliance tissue	Neonatal fat, soft adipose	Clear or tinted

Table 2. Mechanical Properties (Mean ± Variance)

Each SimuGel™ batch undergoes rigorous mechanical testing to ensure consistent performance. These certified metrics validate that your gel will deliver the same realistic feel and needle resistance every time, supporting reproducible training outcomes and reliable R&D results.

Gel	Young's Modulus (MPa)	Needle Resistance (N)	Firmness (g)	Resilience	Density (kg/m^3)
0	0.58 ± 0.08	0.93 ± 0.14	686 ± 52	1.10	945.3
1	0.38 ± 0.04	0.62 ± 0.07	428 ± 32	1.16	935.0
2	0.26 ± 0.04	0.46 ± 0.05	308 ± 32	1.12	967.5
3	0.19 ± 0.03	0.37 ± 0.04	226 ± 22	1.11	856.8
4	0.15 ± 0.02	0.30 ± 0.04	179 ± 14	1.12	934.6
5	0.11 ± 0.02	0.22 ± 0.03	128 ± 19	1.13	1118.7

Mechanical Footnote: Mechanical properties are reported as mean ± variance, calculated directly from Humimic's internal specification windows and 3rd party data. Resilience and density are reported as representative values due to minimal batch-to-batch variation.

Table 3. Acoustic Properties — Frequency-Dependent Attenuation

For ultrasound training and device testing, acoustic accuracy is critical. This data confirms that SimuGel™ closely replicates the speed of sound, impedance, and attenuation characteristics of real human tissue across clinical imaging frequencies (3–10 MHz).

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Pulse-echo ultrasound testing performed in degassed water at 21 ± 0.5 °C.

SimuGel	Speed of Sound (m/s)	Impedance (MRayl)	a (dB/cm·MHz^{-n})	η	α (3 MHz) (dB/cm)	α (5 MHz) (dB/cm)	α (10 MHz) (dB/cm)
0	1449	1.37	0.223	1.700	1.40	3.44	10.90
1	1465	1.37	0.202	1.681	1.22	3.02	9.44
2	1457	1.41	0.192	1.600	1.03	2.52	7.65
3	1459	1.25	0.158	1.679	0.94	2.09	6.30
4	1455	1.36	0.132	1.761	0.82	1.76	5.64
5	1466	1.64	0.132	1.737	0.80	2.20	6.43

Acoustic Footnote:

- Attenuation follows $\alpha(f) = a \times f^{\eta}$
- Clear and tinted versions of the same SimuGel™ formulation share identical mechanical properties
- Any acoustic variation between clear and tinted versions has not been separately characterized
- Speed of sound and impedance values closely approximate soft tissue (≈1540 m/s, 1.38 MRayl)

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Key Notes:

- SimuGel™ formulations are designed to provide realistic tactile, mechanical, and ultrasound performance for medical simulation
- Every production batch ships with a Certificate of Analysis (COA) verifying the material meets Humimic's validated performance tolerances
- Materials remain stable and reusable at room temperature
- Available in clear or tinted variations to support anatomical modeling, vascular embedding, or layered structures
- Ideal for clinical educators, simulation centers, medical device developers, and research laboratories
- Superior ultrasound imaging capabilities with acoustic properties validated across the clinical frequency range (3–10 MHz)

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