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Biomimetic application of *Ianthella basta* demosponge capillary structured chitin scaffolds

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INTRODUCTION

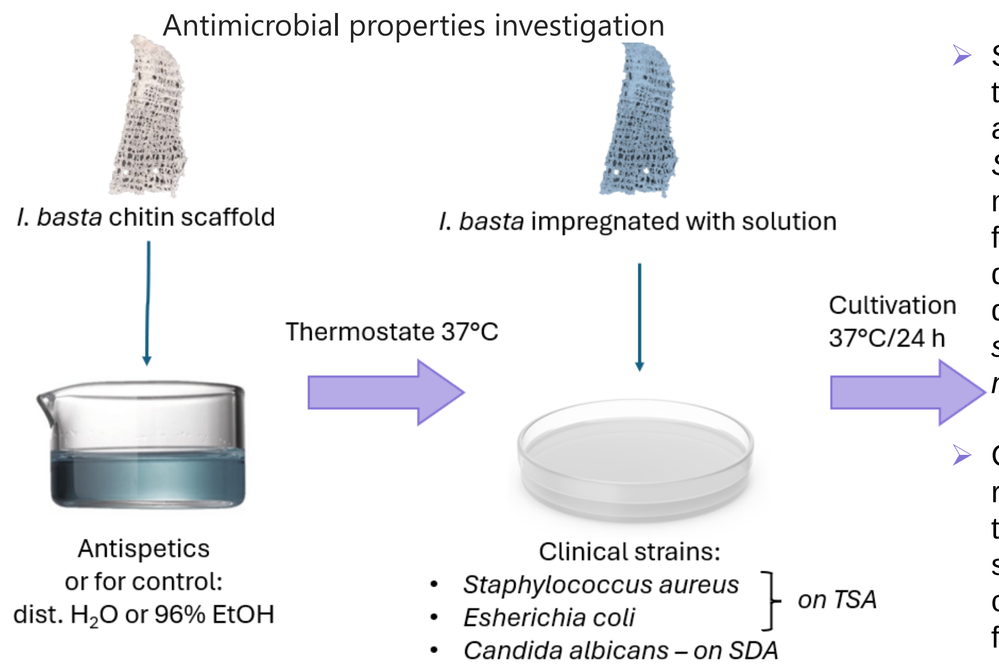
Chitin derived from poriferans exhibits unique properties, including microporous 3D bioarchitecture represented by interconnected microtubular fibres with excellent capillary features. The flat skeleton of *Ianthella basta* marine verongiid demosponge is composed of such tube-like chitin, embodying these distinctive traits. This sponge species is recognized for its extraordinary regenerative abilities, enabling it to regrow at a rate exceeding a dozen centimeters per year. This rapid growth renders it suitable for cultivation under marine farming conditions, thereby providing a sustainable source for production of naturally pre-structured and ready for use chitin.
The aim of this research was to evaluate the in-vitro release of selected antiseptics from the up to 3 mm thick *I. basta* chitinous matrix, demonstrating the potential for its future applications as a natural carrier for antiseptics that mimics already used artificial materials for wound dressing.
For the research, antiseptics were chosen from diverse Anatomical Therapeutic Chemical (ATC) groups, which included dyes, iodine compounds, oxidizers, quaternary ammonium compounds, and biguanides (see Table 1).

Table 1. The list of antiseptics used in the study.

Antiseptic	Active ingredient	Solvents/excipients
Gencyan violet	1% (w/v) methylrosaniline chloride	ethanol 96%
Potassium permanganate	1% (w/v) potassium permanganate	purified water
Rivanol	0,1% (w/v) ethacridine lactate monohydrate	purified water
Iodine	3% (w/v) iodine	ethanol 96% potassium iodide 1%
Bromtyrosine glycerine extract	Glycerine extract from *Aplysina aerophoba*	glycerine
Brilliant green	1% (w/v) brilliant green	ethanol 60%
Sea Buckthorn Oil	Sea Buckthorn oil 100%	-
Decamethoxine	0.1% (w/v)	purified water ethanol 96%
Polyhexanide	0,1% (w/v) polyaminopropilbiguanide	purified water

METHODS

Dried *I. basta* sponge, originating from the Indo-Pacific/Philippines, was identified and purchased from INTIB GmbH, Freiberg, Germany. The 50 x 35 cm- large sponge was initially soaked in distilled water for 2 hours to remove salts and then cut into 4 x 4 cm-large pieces. These pieces were subsequently immersed in a 20% acetic acid solution at RT for 24 hours. Afterward, the skeletal pieces of decellularized sponge skeleton were rinsed with water until reaching a neutral pH, followed by immersion in a 10% NaOH solution at 37°C for 48 h.
Such alternating treatment with acid and base was repeated during 5 days until achieving colorless chitinous scaffolds used in the study.



- Samples, showing the antimicrobial activity against *S. aureus* were moved with sterile forceps to a Petri dish with a fresh daily culture of *the same microorganism.*
- Cultivation was repeated five times with the same samples of chitin scaffold and fresh cultures.

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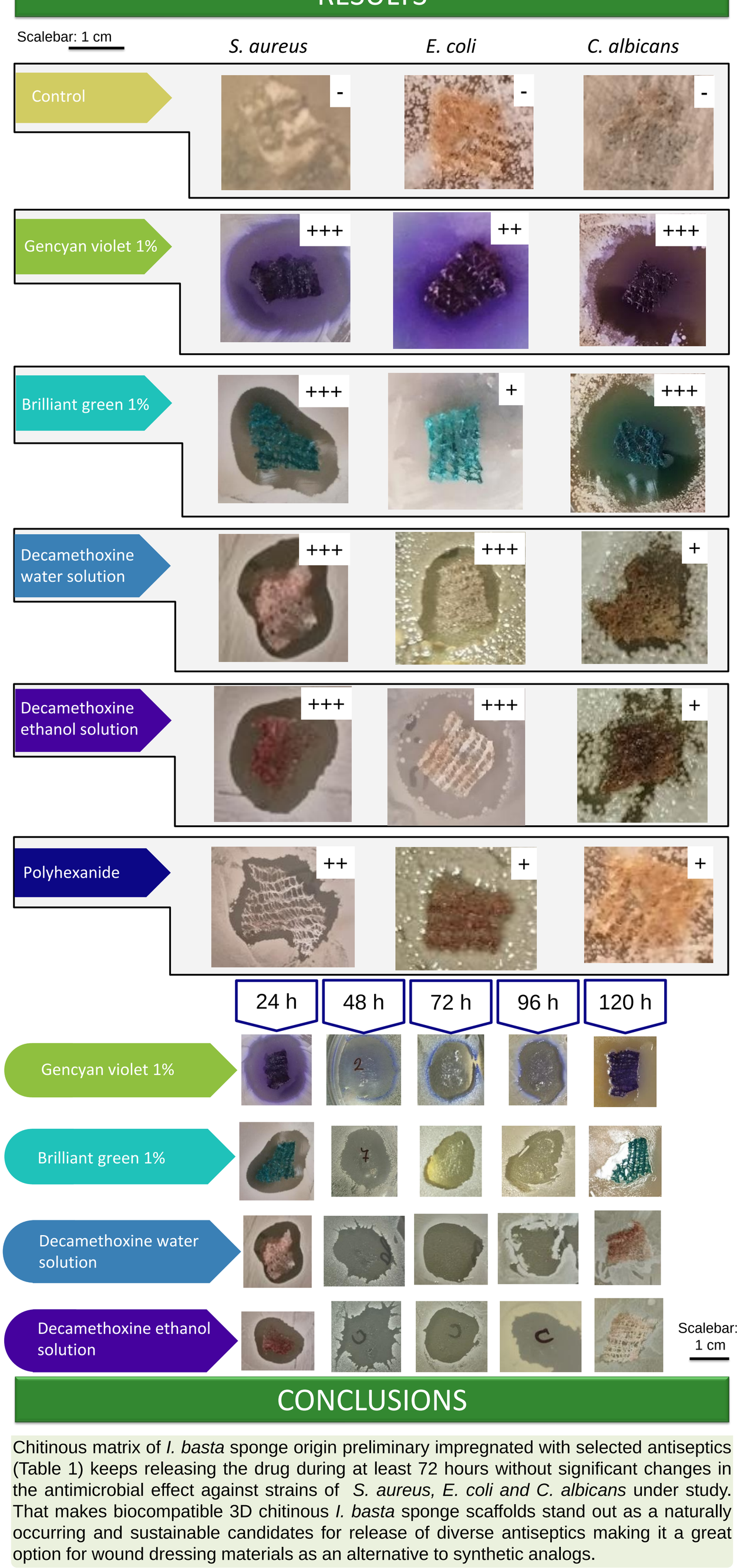
RESULTS



CONCLUSIONS

Chitinous matrix of *I. basta* sponge origin preliminary impregnated with selected antiseptics (Table 1) keeps releasing the drug during at least 72 hours without significant changes in the antimicrobial effect against strains of *S. aureus, E. coli and C. albicans* under study. That makes biocompatible 3D chitinous *I. basta* sponge scaffolds stand out as a naturally occurring and sustainable candidates for release of diverse antiseptics making it a great option for wound dressing materials as an alternative to synthetic analogs.