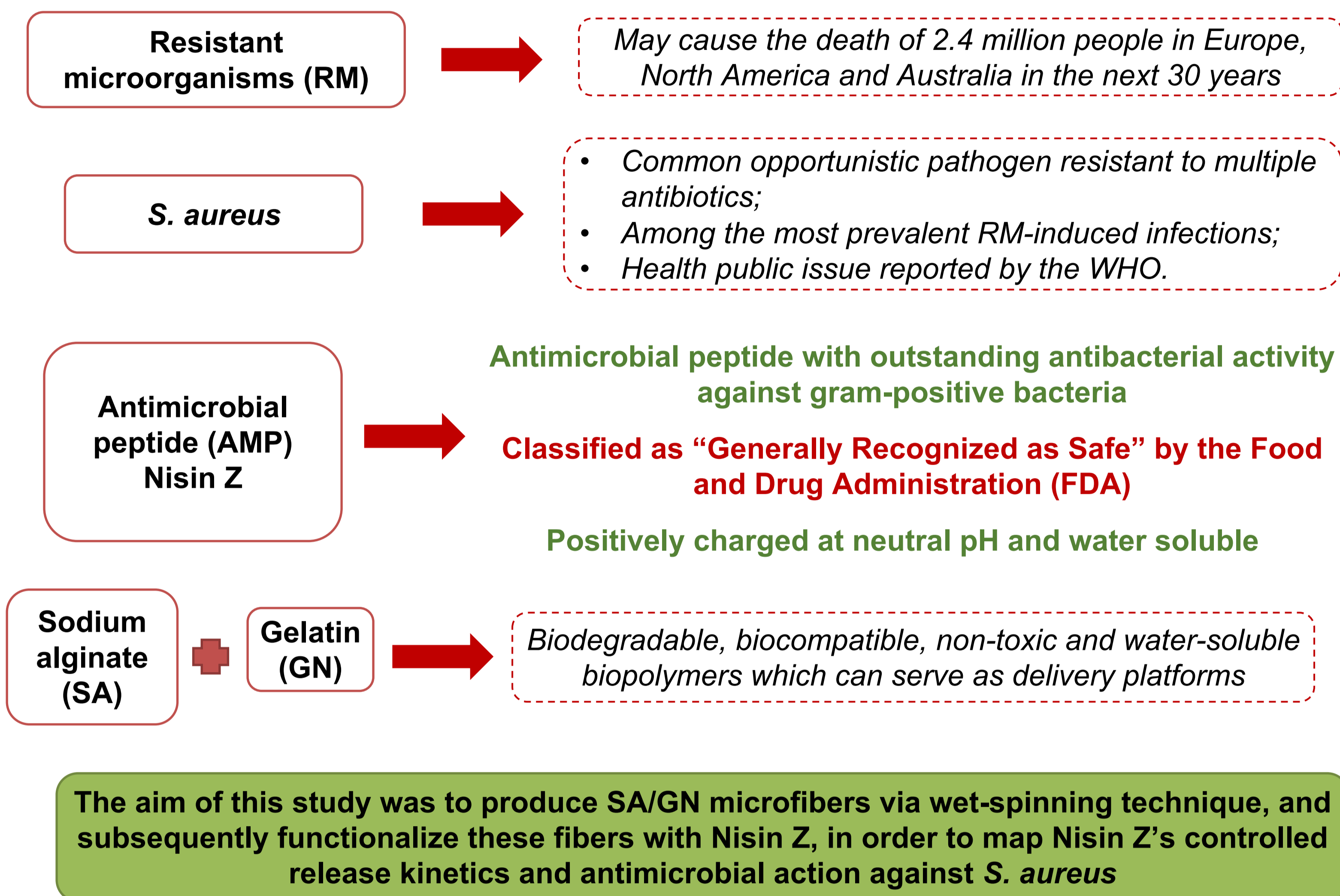


In vitro analysis of Nisin Z-loaded biodegradable wet-spun fibers: controlled release for the inhibition of *Staphylococcus aureus*

Natália C. Homem*, Tânia D. Tavares, Catarina S. Miranda, Joana C. Antunes, Maria T. S. P. Amorim, Helena P. Felgueiras
Centro de Ciência e Tecnologia Têxtil (2C2T), Universidade do Minho, Portugal
*natalia.homem@2c2t.uminho.pt

Introduction



SAGN fiber's production and functionalization

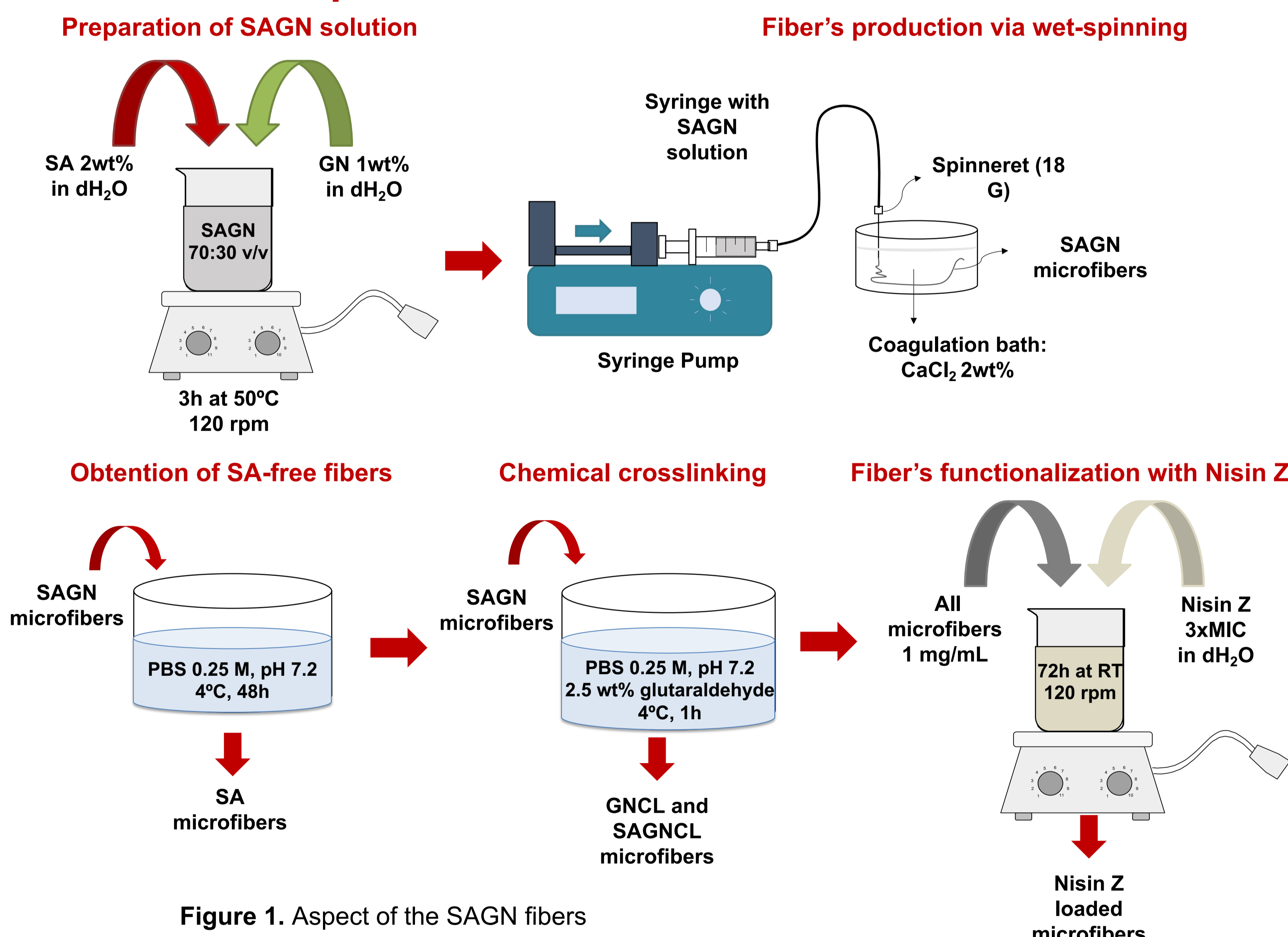


Figure 1. Aspect of the SAGN fibers during (left) and after (right) wet-spinning processing.

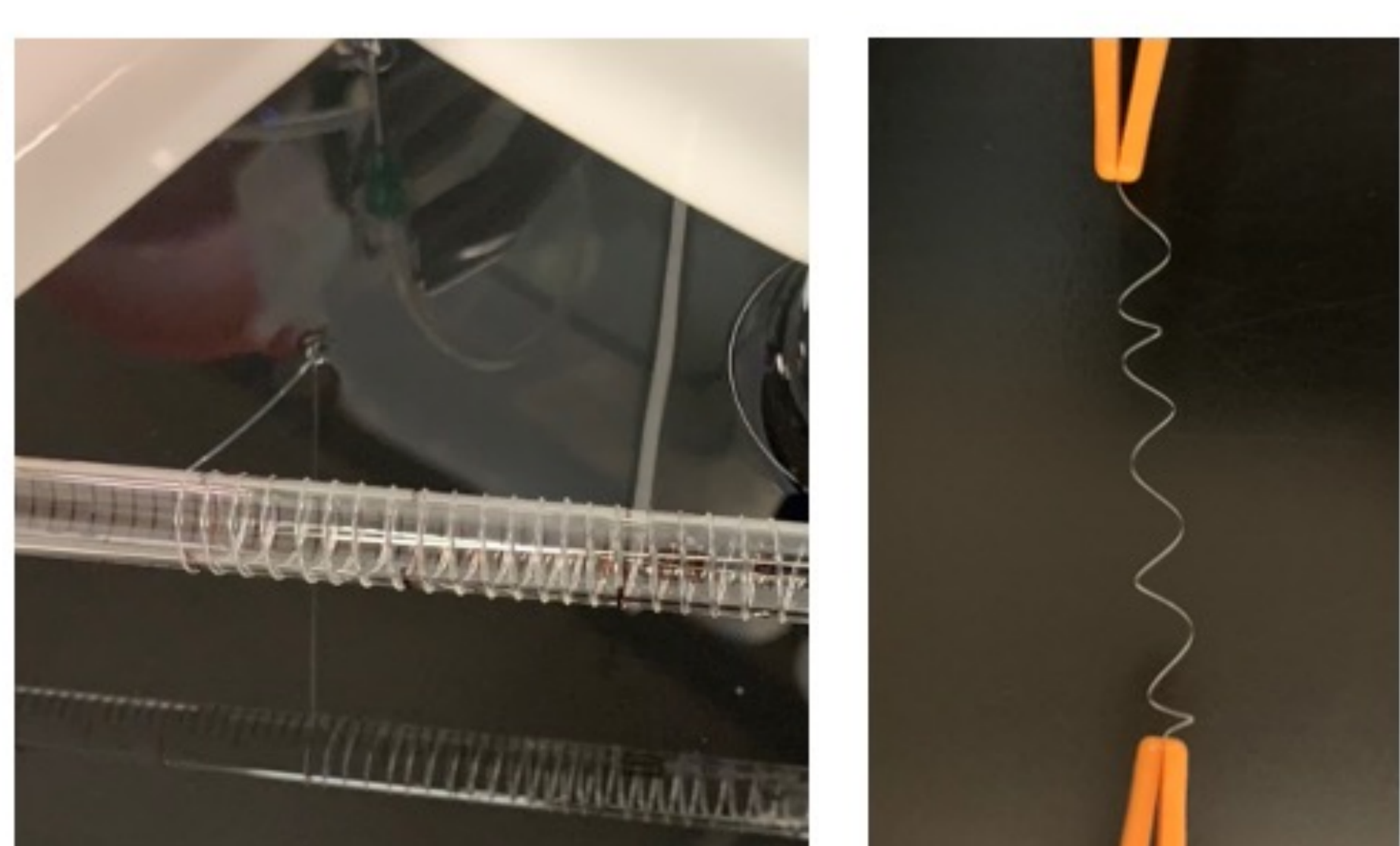
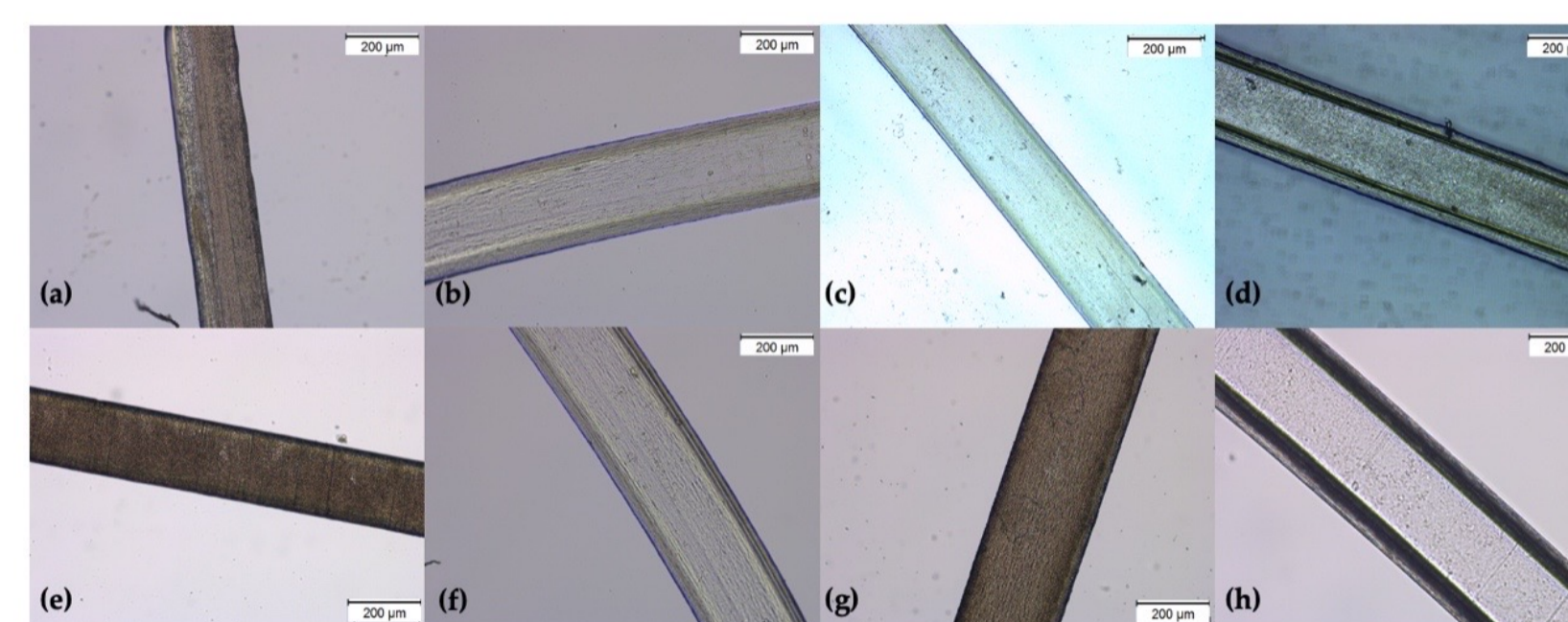


Table 1. Produced fibers and respective treatments employed.

Fiber	SA Removal	Crosslinking	Nisin Z adsorption
SA	No	No	No
SAz	No	No	Yes
SAGN	No	No	No
SAGNz	No	No	Yes
SAGNCL	No	Yes	No
SAGNCLz	No	Yes	Yes
GNCL	Yes	Yes	No
GNCLz	Yes	Yes	Yes

Fibers' morphology

Brightfield microscopy



All microfibers were determined cylindrical, homogeneous and uniform

Table 2. Average fiber diameter (μm) \pm SD.

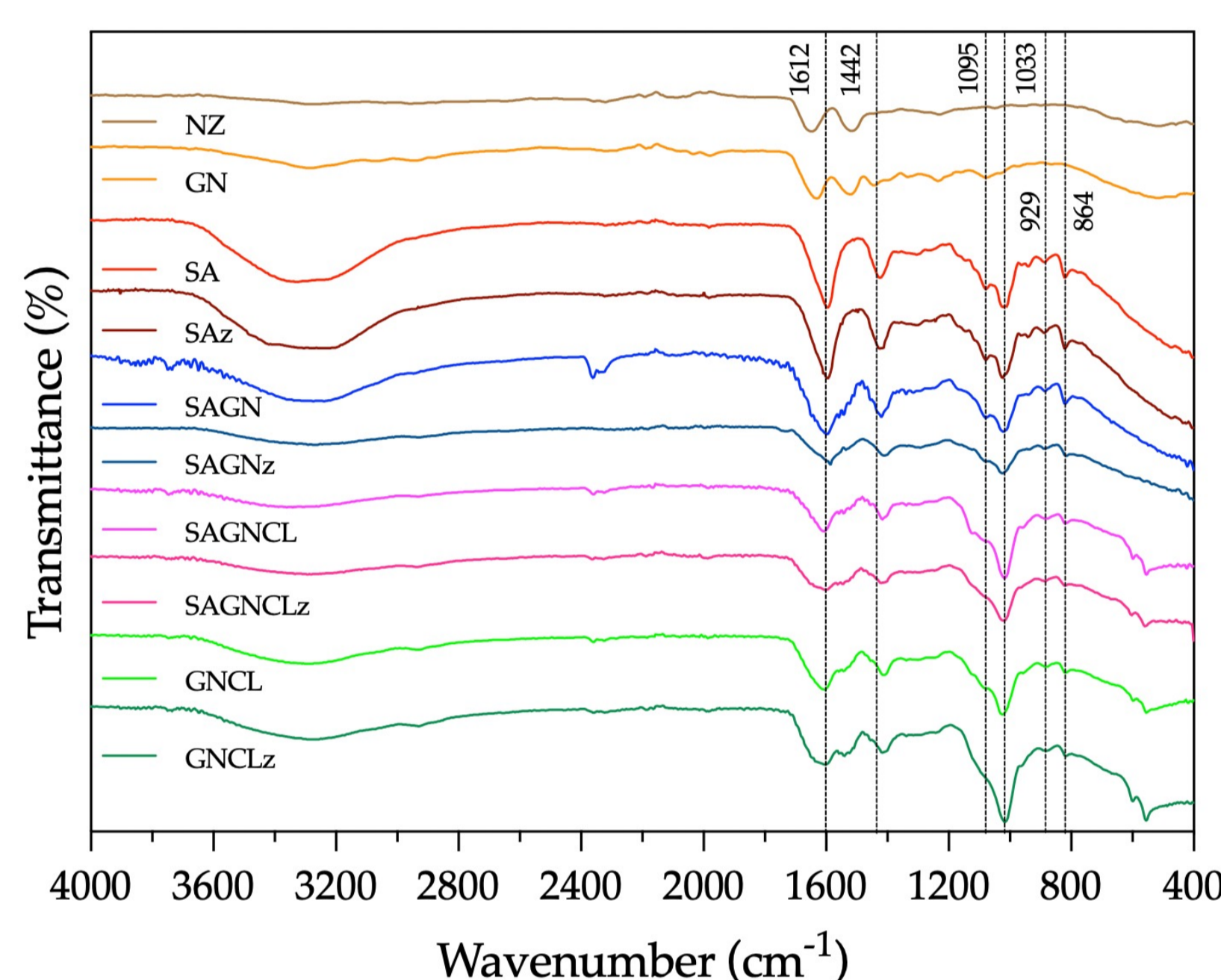
(a)	SA	228.2 \pm 5.1
(b)	SAGN	278.5 \pm 3.2
(c)	SAGNCL	221.0 \pm 6.3
(d)	GNCL	259.2 \pm 4.8
(e)	SAz	223.5 \pm 4.0
(f)	SAGNz	281.2 \pm 3.9
(g)	SAGNCLz	219.3 \pm 7.4
(h)	GNCLz	263.4 \pm 3.6

Table 3. ATR-FTIR peaks detected.

Wavenumber (cm^{-1})	Compound/element	Functional group assigned
≈ 3300	All	-OH
1658	GN	amide-I, C-O, C-N
1640	NZ	Amide groups
1585	SAGN	NH_3^+
1573	SAGN	COO^-
1530	NZ	Primary amines
1489	GN	$-\text{CH}_2-$
1095	SA	C-O
1033	SA	C-C
1030	GN	Amine groups
1020	SA	O-C-O
929	SA	C-O
864	SA	C-O-C
1431 - 1438	SA	COO^-
1608 - 1635	SA	COO^-

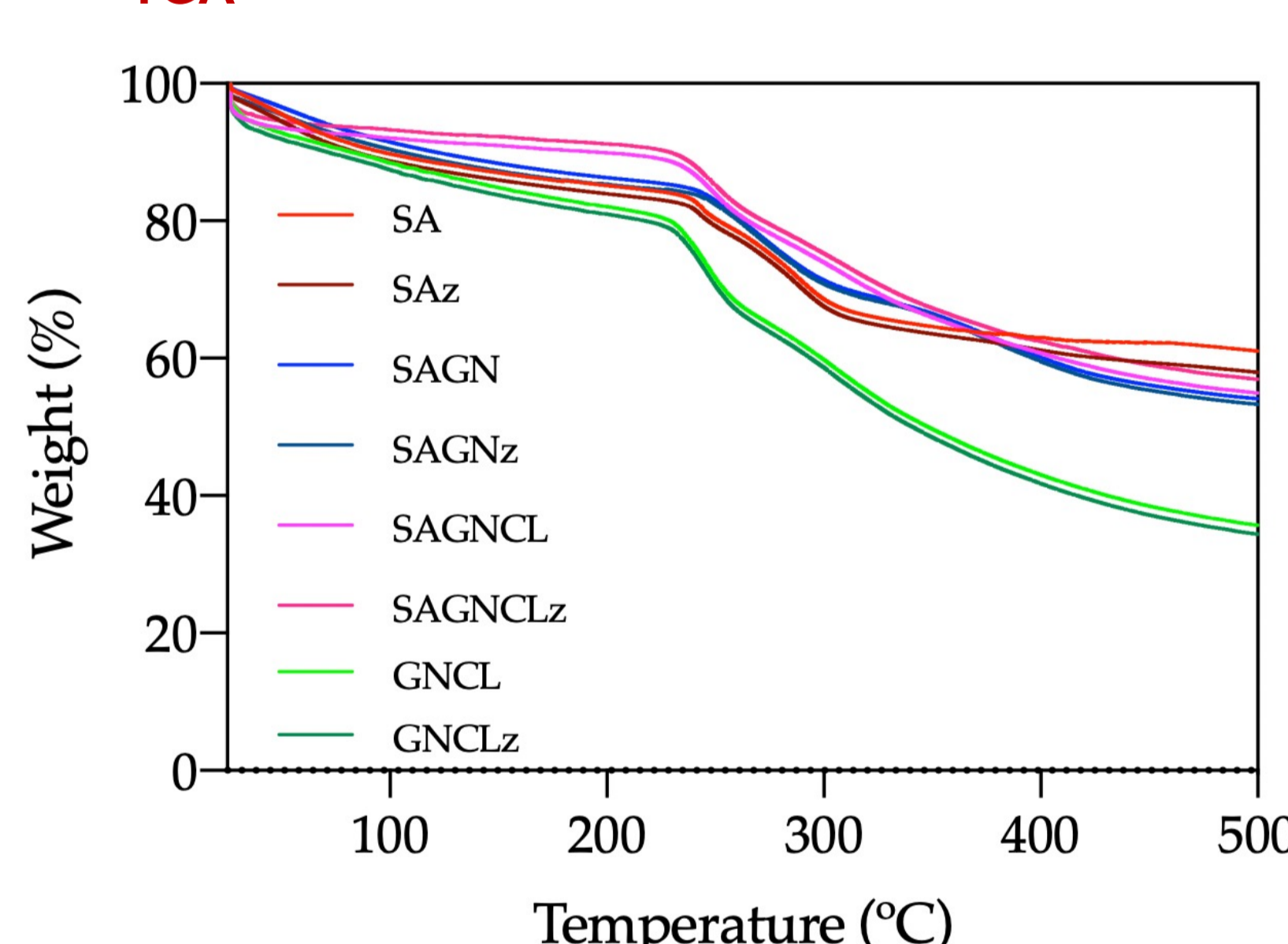
Chemical characterization

ATR-FTIR



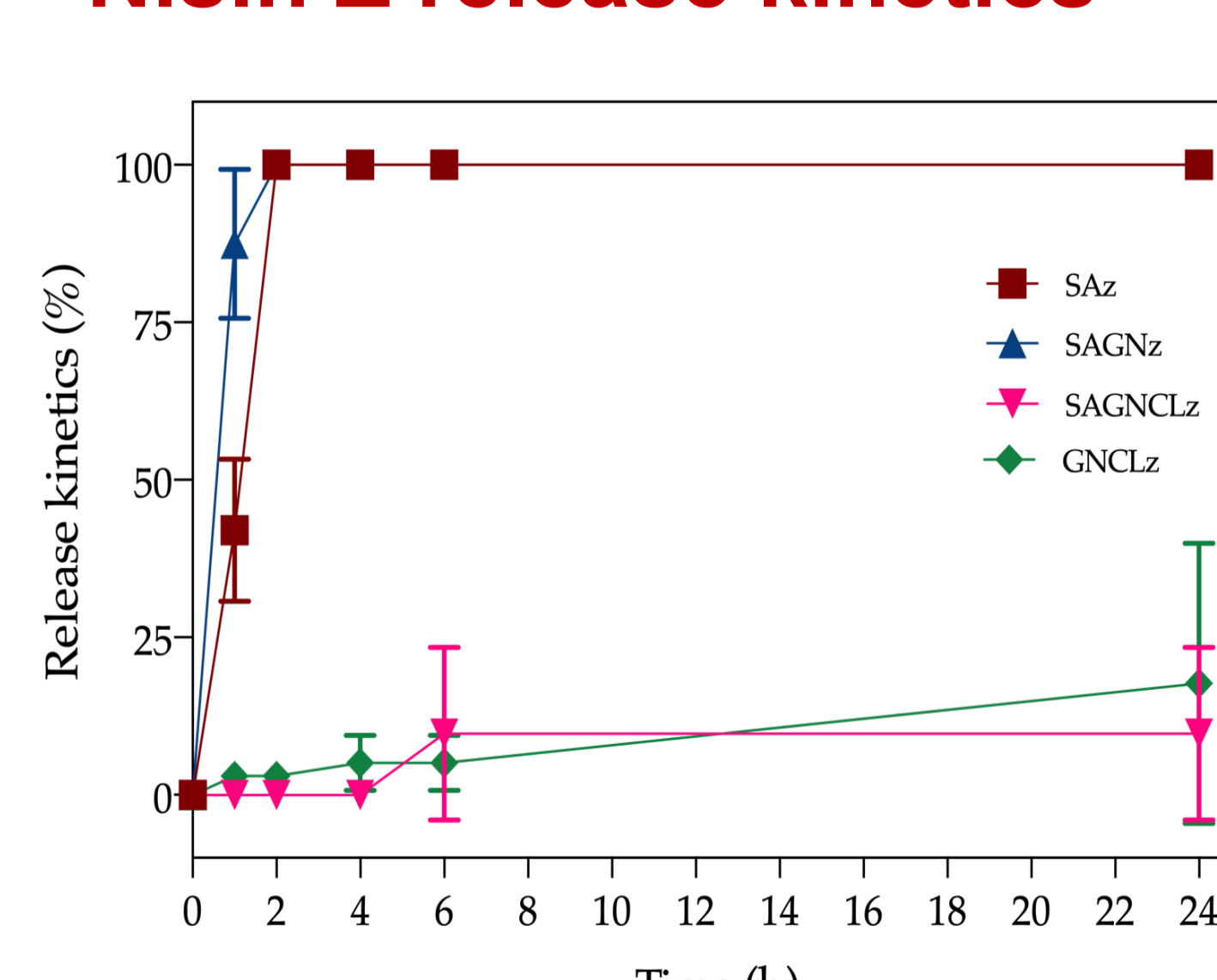
Thermal behaviour

TGA

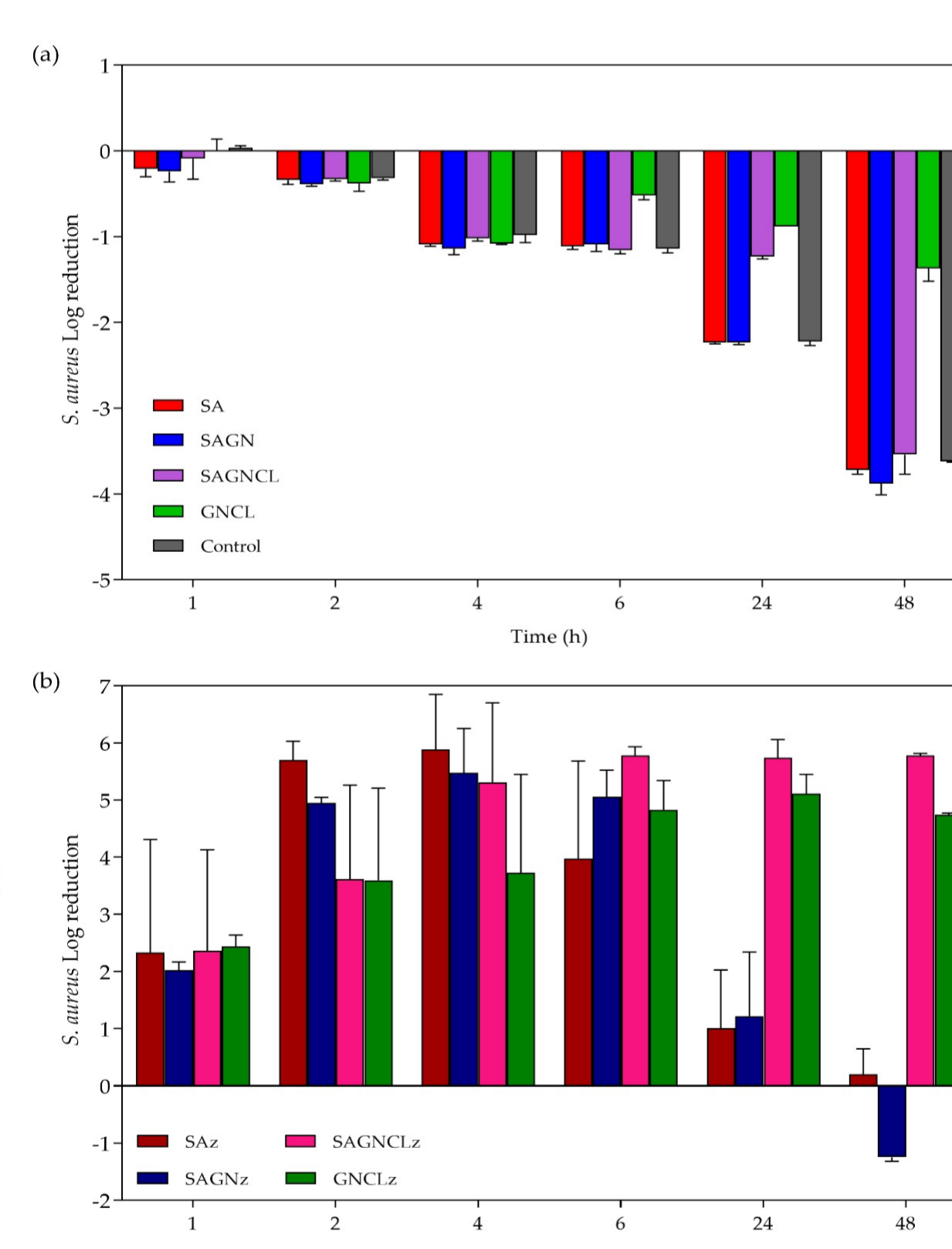


SAGNCL fibers proved to be more thermally resistant due to the crosslinking

Nisin Z release kinetics



Antimicrobial action



Nisin Z had its most impactful effect against the bacteria *S. aureus*, particularly when loaded onto the crosslinked samples. It was capable of progressively eliminating the viable cells, reaching an inhibition superior to 99% after 48 h of culture

The crosslinked fibers induced a more controlled and sustained release of Nisin Z over time

Conclusions

Overall, data revealed the potential of Nisin Z in fighting *S. aureus*-induced infections, while loaded onto biodegradable crosslinked polymeric scaffolds.

Acknowledgments

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