Nanofibrillar cellulose as a Lyoprotective Matrix in The Freeze-Drying of HepG2 Liver Cancer Cells

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INTRODUCTION

Freeze-drying of complex human cells has yielded insufficient viabilities due to the lack of compatible lyoprotective matrices [1]. The usage of nanofibrillar cellulose (NFC) as a lyoprotective matrix is not defined in previous literature. The aim of this thesis is to study the effects of NFC when it is freeze-dried and recreated while carrying 3D cell spheroid systems.

OBJECTIVES

We have evaluated the capabilities of NFC as a lyoprotective matrix in the freeze-drying process of HepG2 cells under sterile conditions. The highest viability was reached trough optimization of the process itself and testing of most suitable compounds for cryo- and lyopreservation (5).

METHODS

A human liver carcinoma cell line HepG2 was cultivated in a mixture of NFC and medium (1) and then freeze-dried and stored in controlled conditions (3). Simultaneously, HepG2 control samples without NFC were freeze-dried and stored in corresponding manner. After rehydration, the viability of both sample types was measured (4) and the mitochondrial activity evaluated. In addition, the morphology of the cells during each step was analyzed (2, 6).

RESULTS

Results demonstrate that without the protective NFC matrix the HepG2 cells could not survive the freeze-drying process. However, when protected by the NFC matrix, the cells gained noticeable viability when rehydrated.

CONCLUSIONS

Nanofibrillar cellulose appears to be a promising candidate as a lyoprotective matrix in the freeze-drying of human cells. The preserved viability during the freeze-drying could lead to the development of new cell products for research and clinical applications in the future.

ACKNOWLEDGEMENTS

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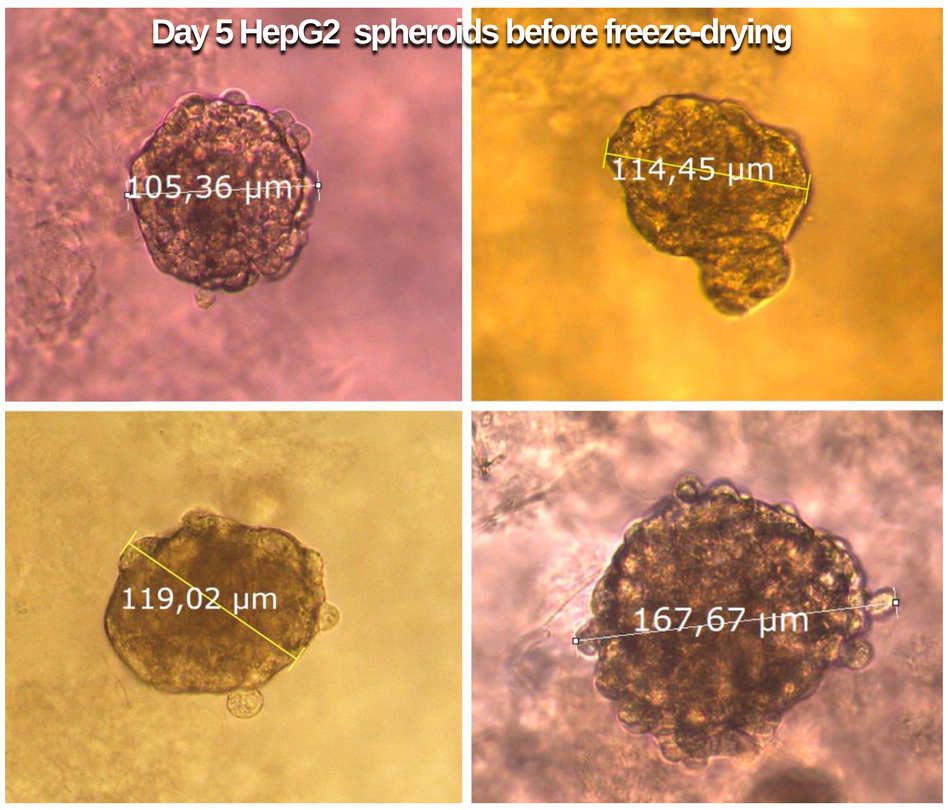
RESULTS

1.



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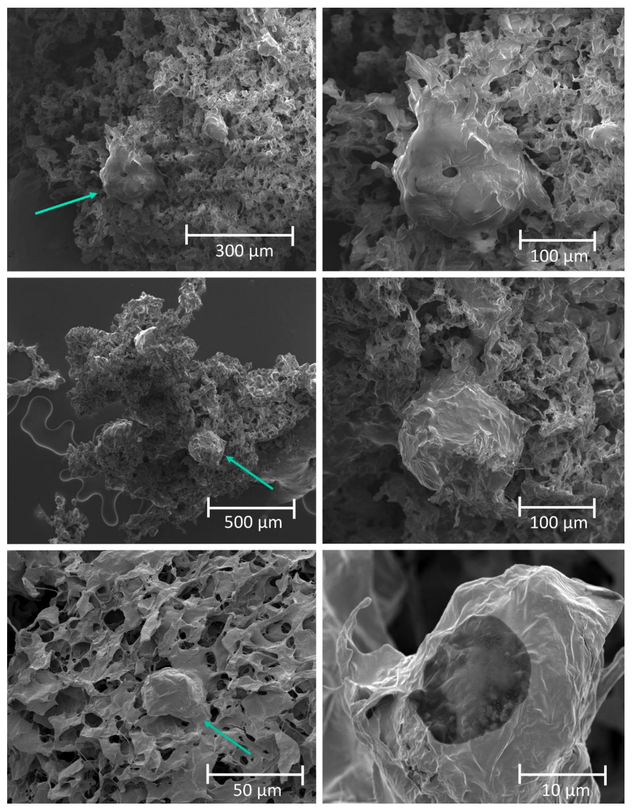

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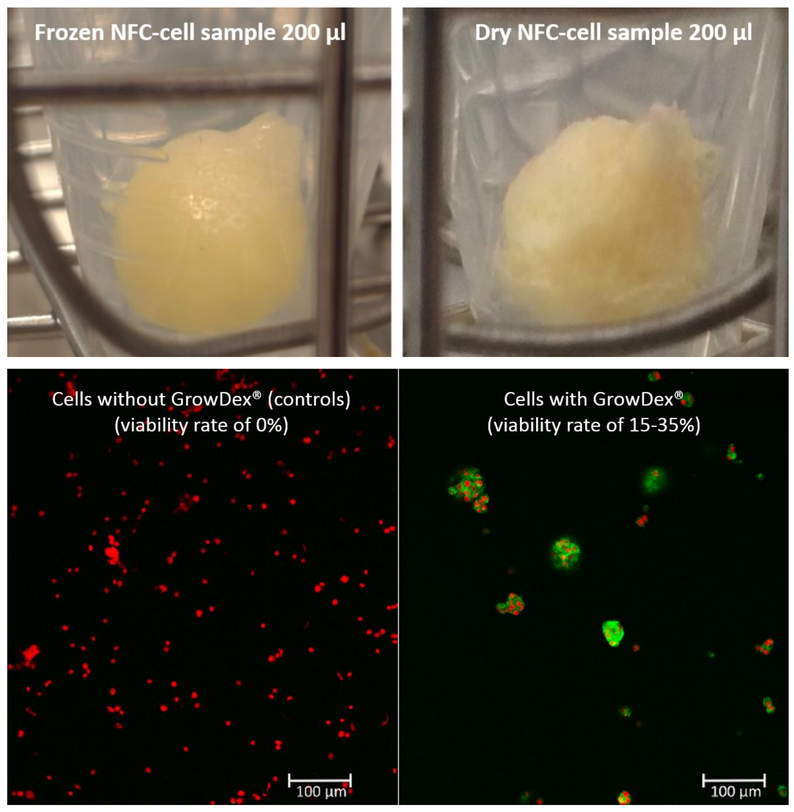

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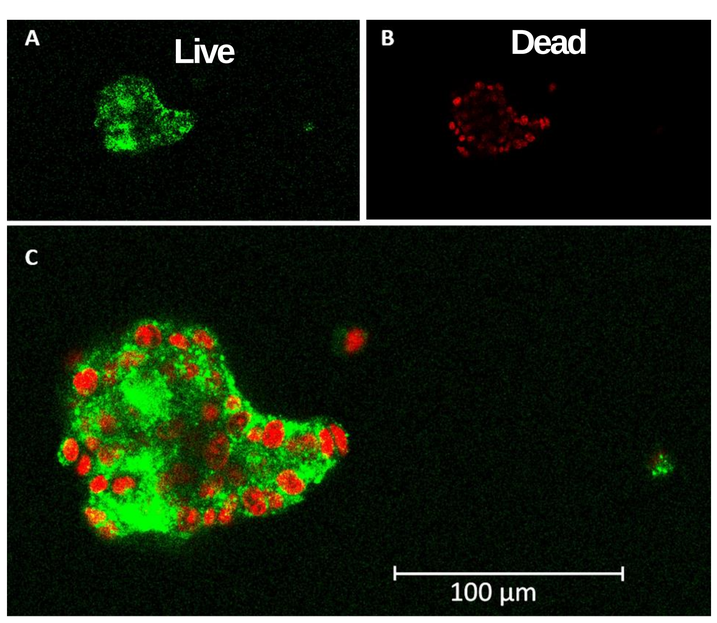
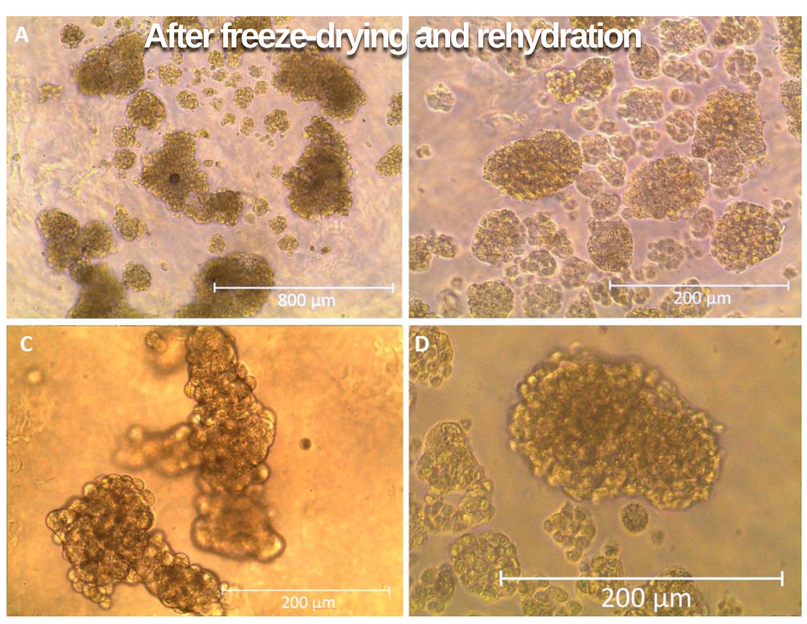


5.

Optimization of Lyoprotectants	PEG 6000 (0.7 wt.%)	Trehalose (0.3 wt.%)	Glycerol (1 wt.%)	Viability (Calcein intensity)
GrowDex® 0.8 wt.% & 24h trehal. incub.	x	x	x	++
GrowDex® 0.8 wt.% & 24h trehal. incub.	x	x		+
GrowDex® 0.8 wt.% & 24h trehal. incub.	x			+
GrowDex® 0.8 wt.% & 24h trehal. incub.			x	++
GrowDex® 0.8 wt.% & 24h trehal. incub.		x	x	++
GrowDex® 0.8 wt.% & 24h trehal. incub.				+
GrowDex® 0.4 wt.% & 24h trehal. incub.	**x**	**x**	**x**	**+++**
GrowDex® 0.4 wt.% & 24h trehal. incub.	x	x		++
GrowDex® 0.4 wt.% & 24h trehal. incub.	x			++
GrowDex® 0.4 wt.% & 24h trehal. incub.			x	++
GrowDex® 0.4 wt.% & 24h trehal. incub.		**x**	**x**	**+++**
GrowDex® 0.4 wt.% & 24h trehal. incub.				++
GrowDex® 0.8 wt.%	x	x		+
GrowDex® 0.8 wt.%		x		+
GrowDex® 0.8 wt.%				+
Without GrowDex®	x	x		
Without GrowDex®		x	x	
Without GrowDex®		x		
Without GrowDex® & 24h treha. Incub.	x	x		
Without GrowDex® & 24h treha. Incub.		x	x	
Without GrowDex® & 24h treha. Incub.		x		

6.



References

[1] Wikström, J. (2013). Alginate-based microencapsulation and lyophilization of human retinal pigment epithelial cell line (ARPE-19) for cell therapy.

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