Covalently Cross-linked Particles based on Arabinoxylans: Antioxidant Activity and Cytotoxicity on a Human Colon Cell Line

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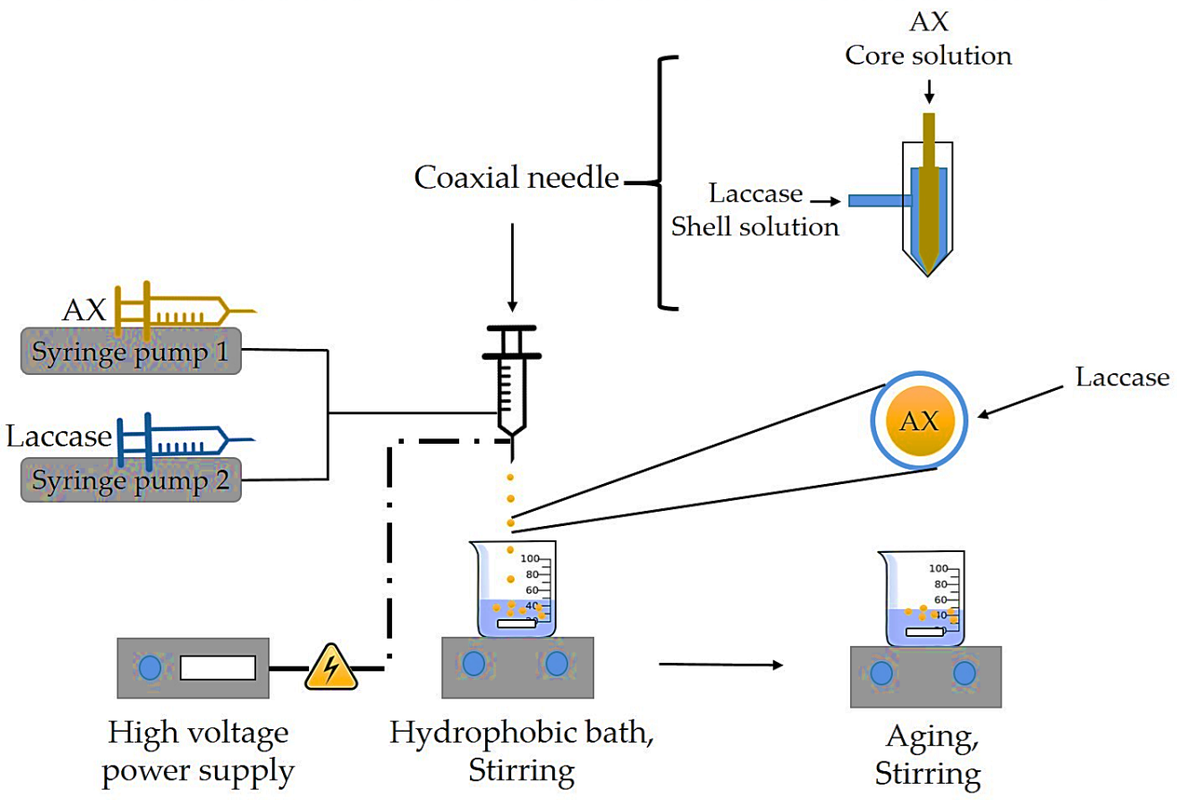
INTRODUCTION

Polysaccharide-based carriers have become attractive materials for the delivery of therapeutics targeted to colon. Ferulated arabinoxylans (AX), polysaccharides with gelling and antioxidant capacities that can be degraded by colonic microbiota are ideal candidates for use as oral drug delivery systems. Recently, AX-based microspheres have demonstrated potential applications as colon-targeted drug carriers. The non-cytotoxicity of AX-based microspheres is a required property for their use as a colon-targeted biomaterial. This study reports the antioxidant activity and cytotoxicity on human colon cells of covalently cross-linked particles based on AX (AXP).

OBJECTIVE: Investigate the antioxidant capacity and cytotoxicity of AXP on human colon cells.

METHODS

PREPARATION OF AXP BY COAXIAL ELECTROSPRAYING



IN VITRO ANTIOXIDANT CAPACITY

Antioxidant capacity of AX and AXP

- **FRAP 630 nm** (1)
- **DPPH 517 nm** (2)
- **ABTS+ 734 nm** (3)

CITOTOXICITY ASSAY

Normal human colon cell line: CCD 841 CoN (ATCC® CRL 1790™)

MTT method (4)

RESULTS

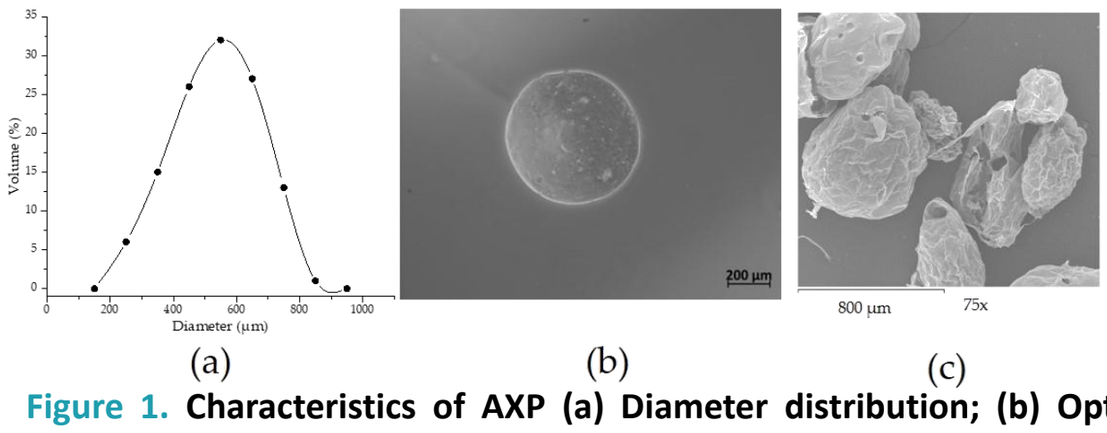


Figure 1. Characteristics of AXP (a) Diameter distribution; (b) Optical microscopy observation at 50× magnification; (d) Scanning electron microscopy of lyophilized AXP

Table 1. Antioxidant activity of AX before and after gelation.

	Antioxidant Activity [a] (µmol TEAC/g)		
Sample	**ABTS⁺**	**DPPH**	**FRAP**
AX	68.05 ± 0.53	32.23 ± 0.50	48.41 ± 1.07
AXP	26.02 ± 3.82	12.58 ± 0.45	16.83 ± 0.83

[a] TEAC, in µmol/g AX or AX gel. All values are means ± standard deviation of duplicate.

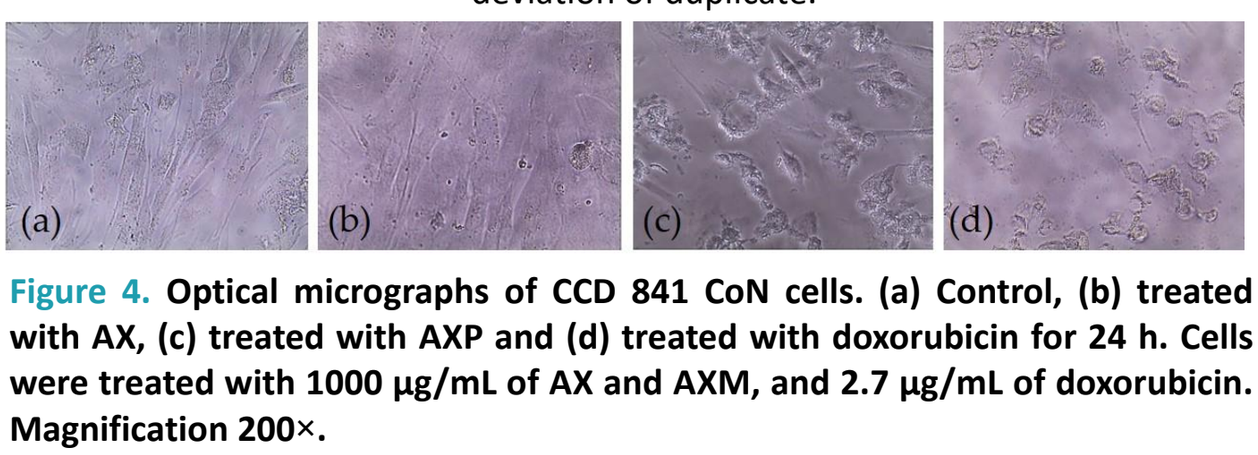


Figure 4. Optical micrographs of CCD 841 CoN cells. (a) Control, (b) treated with AX, (c) treated with AXP and (d) treated with doxorubicin for 24 h. Cells were treated with 1000 µg/mL of AX and AXM, and 2.7 µg/mL of doxorubicin. Magnification 200×.

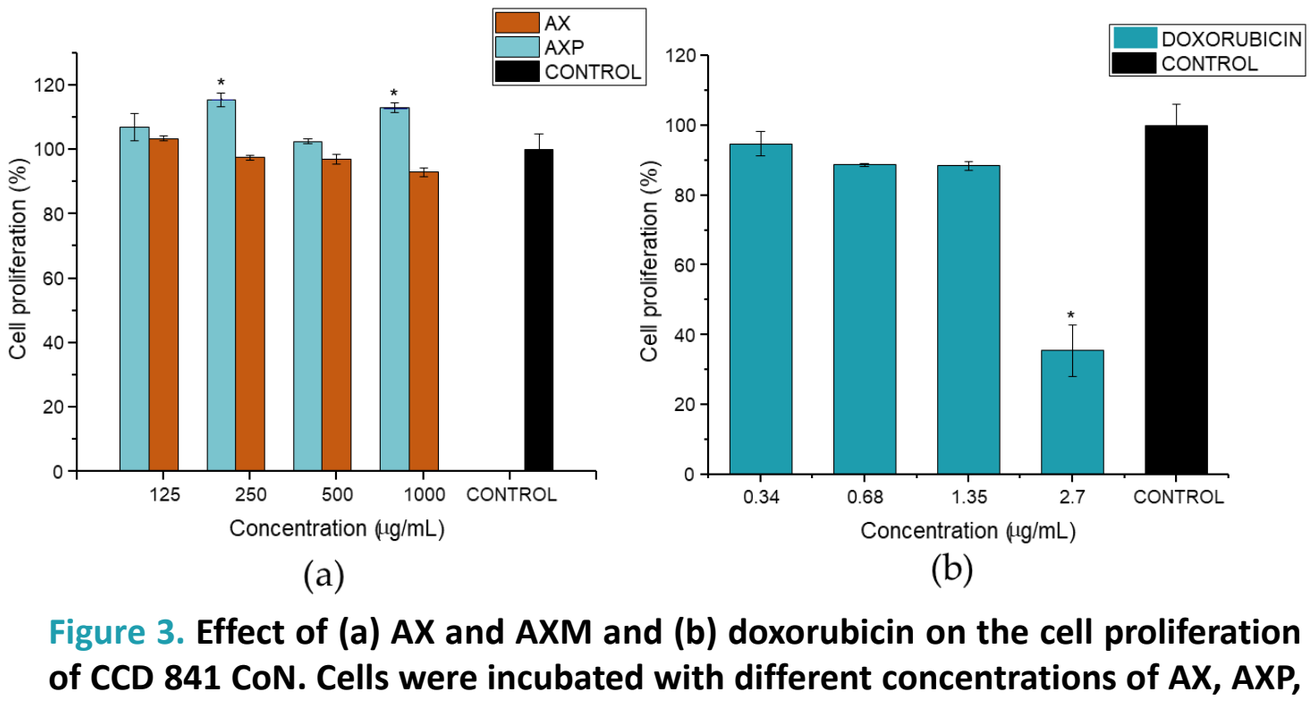


Figure 3. Effect of (a) AX and AXM and (b) doxorubicin on the cell proliferation of CCD 841 CoN. Cells were incubated with different concentrations of AX, AXP, and doxorubicin in cell culture medium for 48 h before cell proliferation was measured. Significant differences ($p < 0.05$) from dissolvent control are marked with asterisk

CONCLUSION

Gelation decreased the antioxidant activity of AX by 61–64 %. AX and AXP did not affect proliferation or show any toxic effect on the regular human colon cell line CCD 841 CoN. AXP are promising biocompatible materials with antioxidant activity. AXP could be suitable materials for the development of drug delivery systems targeted to colon.

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REFERENCES

1. Benzie IFF, Strain JJ. Anal Biochem. 1996;239(1):70–6.
2. Usia, T, Banskota, AH., et al. J Nat Prod. 2002;65(5):673–676.
3. Martínez-López AL, Carvajal-Millan E, et al. Food Composition and Analysis: Methods and Strategies. Toronto: CRC Press; 2014. p. 19–28.
4. Mosmann TJ. Immunol Methods. 1983;65:55–63.