

## References

1. Alberts B, Bray D, Lewis J, Raff M. *Molecular biology of the cell*, 1994, Garland, New York, 2002.
2. Piez K A, Gross J. The Amino Acid Composition of Some Fish Collagens: The Relation between Composition and Structure. *J. Biol. Chem.* vol. 235, no. 4, p. 995, 1960.
3. Liu C Y, Matsusaki M, Akashi M. Cell effects on the formation of collagen triple helix fibers inside collagen gels or on cell surfaces, *Polym. J.* 2015; 47, 5: 391–399.
4. Szot C S, Buchanan C F, Freeman J W, Rylander M N. 3D in vitro bioengineered tumors based on collagen I hydrogels. *Biomaterials* 2011; 32, 31: 7905–7912.
5. Wawro D, Stęplewski W, Brzoza-Malczewska K, Święszkowski W. Collagen-Modified Chitosan Fibres Intended for Scaffolds. *FIBRES & TEXTILES in Eastern Europe* 2012; 6B(96): 32–39.
6. Sionkowska A. Current research on the blends of natural and synthetic polymers as new biomaterials: Review. *Progress in Polymer Science (Oxford)* 2011; 36, 9: 1254–1276.
7. Cardaropoli D, Tamagnone L, Roffredo A, Gaveglia L. Treatment of Gingival Recession Defects Using Coronally Advanced Flap with a Porcine Collagen Matrix Compared to Coronally Advanced Flap with Connective Tissue Graft: A Randomized Controlled Clinical Trial. *J. Periodontol* 2012; 83, 3: 321–328.
8. Sui Z, Pang W, Wei Y, Song J. Structure and properties of modified flax yarn with collagen. *FIBRES & TEXTILES in Eastern Europe* 2015; 23, 1(109): 30-34.
9. Bokova E, Kovalenko G, Filatov I, Pawlova M, Stezhka K. Obtaining New Biopolymer Materials by Electrospinning. *FIBRES & TEXTILES in Eastern Europe* 2017; 25, 6 (126): 31–33. DOI: 10.5604/01.3001.0010.5365.
10. Nagai T, Suzuki N. Isolation of collagen from fish waste material - Skin, bone and fins. *Food Chem.* 2000, 68, 3: 277–281.
11. Przybylski J E. Patent US 7285638, B2, 2007.
12. Ramachandran G N. *Treatise on Collagen*, London and New York, 1967.
13. Safandowska M, Pietrucha K. Effect of fish collagen modification on its thermal and rheological properties. *Int. J. Biol. Macromol.* 2013; 53: 32–37.
14. Shoulders M D, Raines R T. Collagen Structure and Stability. *Annu. Rev. Biochem.*, 2009.
15. Bella J, Brodsky B, Berman H M. Hydration structure of a collagen peptide. *Structure* 1995; 3, 9: 893–906.
16. Schmitt F O, Gross J, Highberger J H. A New Particle Type in Certain Connective Tissue Extracts. *Proc. Natl. Acad. Sci. U. S. A.* 1953; 39, 6: 459–470.
17. Doyle BB, Bendit EG, Blout ER. Infrared spectroscopy of collagen and collagen-like polypeptides. *Biopolymers*, 1975.
18. Barth A, Zscherp C. What vibrations tell about proteins. *Q. Rev. Biophys.* 2002; 35, 4.
19. Zerbi G. Front Matter -- Modern Polymer Spectroscopy. *Mod. Polym. Spectrosc.*, 1999.
20. Overman SA, Thomas GJ. Raman markers of nonaromatic side chains in an alpha-helix assembly: Ala, Asp, Glu, Gly, Ile, Leu, Lys, Ser, and Val residues of phage fd subunits. *Biochemistry* 1999; 38, 13: 4018–4027.
21. Rygula A, Majzner K, Marzec K M, Kaczor A, Pilarczyk M, Baranska M. Raman spectroscopy of proteins: A review. *Journal of Raman Spectroscopy* 2013, 44, 8: 1061–1076.

22. Lasek W. Kolagen: *Chemia i Wykorzystanie*. Wydawnictwa Naukowo Technicze, 1978.
23. Overman S A, Thomas G J. Amide modes of the  $\alpha$ -helix: Raman spectroscopy of filamentous virus fd containing peptide  $^{13}\text{C}$  and  $^2\text{H}$  labels in coat protein subunits. *Biochemistry* 1998; 37, 16: 5654–5665.
24. Gauza-Włodarczyk M, Kubisz L, Włodarczyk D. Amino acid composition in determination of collagen origin and assessment of physical factors effects. *Int. J. Biol. Macromol.* 2017; 104: 987–991.
25. Nemethy G, Scheraga H A. Stabilization of Collagen Fibrils by Hydroxyproline. *Biochemistry* 1986; 25, 11: 3184–3188.
26. Ramachandran G N, Ramakrishnan C. *Molecular Structure BT - Biochemistry of Collagen*. G. N. Ramachandran and A. H. Reddi, Eds. Boston, MA: Springer US, 1976, pp. 45–84.
27. Renugopalakrishnan V, Kloumann P H B, Bhatnagar R S. L-Alanyl-glycylglycine: FT-IR and Raman spectroscopic evidence for tripeptide packing in a collagenlike arrangement. *Biopolymers* 1984; 23, 4: 623–627.
28. Herrero A M. Raman spectroscopy for monitoring protein structure in muscle food systems. *Crit. Rev. Food Sci. Nutr.* 2008; 48, 6: 512–523.
29. Pelton J T, McLean L R. Spectroscopic methods for analysis of protein secondary structure. *Analytical Biochemistry* 2000; 277, 2: 167–176.
30. Kitagawa T, Hirota S. *Raman Spectroscopy of Proteins* in Handbook of Vibrational Spectroscopy, L. John Wiley&Sons, Ed. 2006.
31. Herrero A M. Raman spectroscopy for monitoring protein structure in muscle food systems. *Crit. Rev. Food Sci. Nutr.*, 2008.
32. Gullekson C, Lucas L, Hewitt K, Kreplak L. Surface-sensitive Raman spectroscopy of collagen I fibrils. *Biophys. J.* 2011; 100, 7: 1837–1845.
33. Siamwiza M N, Lord R C, Chen M C, Takamatsu T, Harada I, Matsuura H, Shimanouchi T. Interpretation of the doublet at  $850$  and  $830\text{ cm}^{-1}$  in the Raman spectra of tyrosyl residues in proteins and certain model compounds. *Biochemistry* 1975; 14, 22: 4870–4876.
34. Thomas G J. New structural insights from Raman spectroscopy of proteins and their assemblies. *Biopolymers* 2002; 67, 4-5: 214–225.
35. Sugeta H, Go A, Miyazawa T. Vibrational Spectra and Molecular Conformations of Dialkyl Disulfides. *Bull. Chem. Soc. Jpn.* 1973; 46, 11: 3407–3411.
36. Ogawa M, Portier R J, Moody M W, Bell J, Schexnayder M A, Losso J N. Biochemical properties of bone and scale collagens isolated from the subtropical fish black drum (*Pogonias cromis*) and sheepshead seabream (*Archosargus probatocephalus*). *Food Chem.* 2004.
37. Kühn K, Engel J, Zimmermann B, Grassmann W. Renaturation of soluble collagen: III. Reorganization of native collagen molecules from completely separated units. *Arch. Biochem. Biophys.* 1964; 105, 2: 387–403.
38. Renugopalakrishnan V, Collette C L, T W, Dobbs J. Non-uniform Triple Helical Structure in Chick Skin Type I Collagen on Thermal Denaturation: Raman Spectroscopic Study. *Z. Naturforsch.*, 1998; 53c: 383–388.
39. Kuzan A, Smulczyńska-Demel A, Chwiłkowska A, Saczko J, Frydrychowski A, Dominiak M. An estimation of the biological properties of fish collagen in an experimental in vitro study. *Adv. Clin. Exp. Med.*, 2015; 24, 3: 385–392.
40. Tuma R. Raman spectroscopy of proteins: From peptides to large assemblies. *J. Raman Spectrosc.*, 2005; 36, 4: 307–319.

41. Gasior-Głogowska M, Komorowska M, Hanuza J, Maczka M, Kobielszczak M, Structural alteration of collagen fibres - spectroscopic and mechanical studies. *Acta Bioeng. Biomech.* 2010; 12, 4: 53–60.
42. Mary Y S, Ushakumari L, Harikumar B, Varghese H T, Panicker C Y. FT-IR, FT-Raman and SERS spectra of L-proline. *J. Iran. Chem. Soc.* 2009; 6, 1: 138–144.