

Urolithiasis, the process of urinary stone formation, entails the presence of compact masses like whewellite, brushite, and urate within the urinary system. Gout, characterized by inflammatory arthritis, emerges from the accumulation of urate (MSUM) crystals. In vitro, examinations focusing on the growth of whewellite (COM), brushite (CHPD), and urate (MSUM) crystals on glass slides present a cost-effective approach for gaining valuable insights into urolithiasis and gout. These studies not only delve into crystal growth patterns but also investigate the potential inhibition of crystal growth through the application of plant infusions, thereby laying the foundation for further extensive research in these domains.



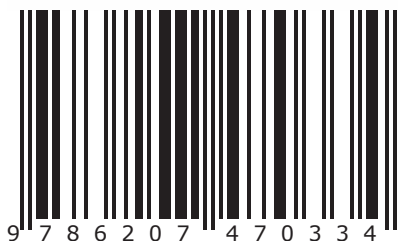
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How to Grow Urinary Stone and Gouty Crystals on Glass Slide

Exploring Morphologies, Disease Insights, and Herbal Inhibition Strategies



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**How to Grow Urinary Stone and Gouty Crystals on Glass Slide:
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Strategies**

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REFERENCES

1. Khan, S., *Animal models of kidney stone formation: an analysis*. World Journal of Urology, 1997. **15**(4): p. 236-243.
2. Skolarikos, A., et al. *Urolithiasis*. in *EAU Guidelines. Edn. presented at the EAU Annual Congress Amsterdam*. 2022.
3. Alelign, T. and B. Petros, *Kidney Stone Disease: An Update on Current Concepts*. Advances in Urology, 2018. **2018**: p. 3068365.
4. O’Kell, A.L., D.C. Grant, and S.R. Khan, *Pathogenesis of calcium oxalate urinary stone disease: species comparison of humans, dogs, and cats*. Urolithiasis, 2017. **45**(4): p. 329-336.
5. Chew, D.J., S.P. DiBartola, and P.A. Schenck, *Chapter 9 - Urolithiasis*, in *Canine and Feline Nephrology and Urology (Second Edition)*, D.J. Chew, S.P. DiBartola, and P.A. Schenck, Editors. 2011, W.B. Saunders: Saint Louis. p. 272-305.
6. Aggarwal, A., et al., *Diminution of oxalate induced renal tubular epithelial cell injury and inhibition of calcium oxalate crystallization in vitro by aqueous extract of Tribulus terrestris*. International Brazilian Journal of Urology, 2010. **36**(4): p. 480-489.
7. Fischer, V., K. Landfester, and R. Munoz-Espi, *Stabilization of calcium oxalate metastable phases by oligo (L-glutamic acid): effect of peptide chain length*. Crystal Growth & Design, 2011. **11**(5): p. 1880-1890.
8. Wesson, J.A. and M.D. Ward, *Pathological biomineralization of kidney stones*. Elements, 2007. **3**(6): p. 415-421.

9. Sheng, X., et al., *Adhesion at calcium oxalate crystal surfaces and the effect of urinary constituents*. Proceedings of the National Academy of Sciences of the United States of America, 2005. **102**(2): p. 267-272.
10. Khan, S.R. and D.J. Kok, *Modulators of urinary stone formation*. Frontiers in Bioscience, 2004. **9**(629): p. 1450-1482.
11. Farmanesh, S., et al., *Specificity of growth inhibitors and their cooperative effects in calcium oxalate monohydrate crystallization*. Journal of the American Chemical Society, 2014. **136**(1): p. 367-376.
12. Millan, A., *Crystal morphology and texture in calcium oxalate monohydrate renal calculi*. Journal of Materials Science: Materials in Medicine, 1997. **8**(5): p. 247-250.
13. Chien, Y.-C., et al., *Modulation of calcium oxalate dihydrate growth by selective crystal-face binding of phosphorylated osteopontin and polyaspartate peptide showing occlusion by sectoral (compositional) zoning*. Journal of Biological Chemistry, 2009. **284**(35): p. 23491-23501.
14. Xie, B., et al., *Aggregation of Calcium Phosphate and Oxalate Phases in the Formation of Renal Stones*. Crystal Growth & Design, 2015. **15**(1): p. 204-211.
15. Joseph, K., B.B. Parekh, and M. Joshi, *Inhibition of growth of urinary type calcium hydrogen phosphate dihydrate crystals by tartaric acid and tamarind*. Current Science, 2005. **88**(8): p. 1232-1238.
16. Rajendran, K. and C.D. Keefe, *Growth and characterization of calcium hydrogen phosphate dihydrate crystals from single diffusion gel technique*. Crystal Research and Technology, 2010. **45**(9): p. 939-945.

17. Selvaraju, R. and G. Vasuki, *Growth of calcium hydrogen phosphate dihydrate (CHPD) crystal and characterization studied by spectral method*. International Journal of Current Advanced Research, 2013. **3**(10): p. 40-42.
18. Parekh, B.B. and M. Joshi, *Crystal growth and dissolution of brushite crystals by different concentration of citric acid solutions*. Indian Journal of Pure and Applied Physics, 2005. **43**(9): p. 675-678.
19. Diana, K. and K. George, *Urinary stone formation: Efficacy of seed extract of Ensete superbum (Roxb.) Cheesman on growth inhibition of calcium hydrogen phosphate dihydrate crystals*. Journal of Crystal Growth, 2013. **363**: p. 164-170.
20. Joshi, V.S., et al., *Inhibition of the growth of urinary calcium hydrogen phosphate dihydrate crystals with aqueous extracts of Tribulus terrestris and Bergenia ligulata*. Urological Research, 2005. **33**(2): p. 80-86.
21. KC, M. and S. Leslie. *Uric Acid Nephrolithiasis*. [Updated 2023 Oct 15]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK560726/>. 2023.
22. Moe, O.W., *Uric acid nephrolithiasis: proton titration of an essential molecule?* Current Opinion in Nephrology and Hypertension, 2006. **15**(4): p. 366-373.
23. Ringertz, H., *Optical and crystallographic data of uric acid and its dihydrate*. Acta Crystallographica, 1965. **19**(2): p. 286-287.
24. Sutor, D. and S. Scheidt, *Identification standards for human urinary calculus components, using crystallographic methods*. British Journal of Urology, 1968. **40**(1): p. 22-28.

25. Rinaudo, C. and R. Boistelle, *The occurrence of uric acids and the growth morphology of the anhydrous monoclinic modification: C₅H₄N₄O₃*. Journal of Crystal Growth, 1980. **49**(3): p. 569-579.
26. Schubert, G., et al., *Uric acid monohydrate—a new urinary calculus phase*. Urological Research, 2005. **33**(3): p. 231-238.
27. Hesse, A., et al., *Uric acid dihydrate as urinary calculus component*. Investigative Urology, 1975. **12**(5): p. 405-409.
28. Martillo, M., L. Nazzal, and D. Crittenden, *The crystallization of monosodium urate*. Current Rheumatology Report, 2014. **16**(2): p. 400.
29. Perrin, C.M., et al., *Monosodium urate monohydrate crystallization*. CrystEngComm, 2011. **13**(4): p. 1111-1117.
30. Ahmad, M.I., et al., *Urate Crystals; Beyond Joints*. Frontiers in Medicine, 2021. **8**: p. <https://doi.org/10.3389/fmed.2021.649505>.
31. Grover, P.K., V.R. Marshall, and R.L. Ryall, *Dissolved urate salts out calcium oxalate in undiluted human urine in vitro: implications for calcium oxalate stone genesis*. Chemistry & Biology, 2003. **10**(3): p. 271-278.
32. Kalkura, S.N., et al., *In-vitro crystallization of spherulites of monosodium urate monohydrate*. Journal of Materials Science: Materials in Medicine, 1995. **6**(10): p. 577-580.
33. Karki, N. and L. SW. *Struvite and Triple Phosphate Renal Calculi*. [Updated 2023 May 30]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK568783/>. 2023.

34. Leslie, S., S. H, and L. Nazzal. *Cystinuria*. [Updated 2023 May 30]. In: *StatPearls [Internet]*. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK470527/>. 2023.
35. Dalbeth, N., et al., *Gout*. Nature Reviews Disease Primers, 2019. **5**(1): p. 69.
36. Chhana, A., G. Lee, and N. Dalbeth, *Factors influencing the crystallization of monosodium urate: a systematic literature review*. BMC Musculoskeletal Disorders, 2015. **16**(1): p. 296.
37. Roman, Y.M., *The Role of Uric Acid in Human Health: Insights from the Uricase Gene*. Journal of Personalized Medicine, 2023. **13**(9): p. 1409.
38. Rosenthal, A.K. and L.M. Ryan, *Calcium Pyrophosphate Deposition Disease*. New England Journal of Medicine, 2016, **374**(26): p. 2575-2584.
39. Zamora EA and N. R. *Calcium Pyrophosphate Deposition Disease*. [Updated 2023 Jun 20]. In: *StatPearls [Internet]*. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK540151/>. 2023.
40. Grohe, B., et al., *Crystallization kinetics of calcium oxalate hydrates studied by scanning confocal interference microscopy*. Journal of Crystal Growth, 2006. **295**(2): p. 148-157.
41. Millan, A., et al., *Semi-Batch Precipitation of Calcium Oxalate Monohydrate*. Crystal Research and Technology, 1992. **27**(1): p. 31-39.
42. Grases, F., A. Millan, and A. Conte, *Production of calcium oxalate monohydrate, dihydrate or trihydrate*. Urological research, 1990. **18**(1): p. 17-20.

43. Carvalho, M. and M.A. Vieira, *Changes in calcium oxalate crystal morphology as a function of supersaturation*. International Brazilian Journal of Urology, 2004. **30**(3): p. 205-209.
44. Grases, F., R. Prieto, and A. Costa-Bauza, *In vitro models for studying renal stone formation: a clear alternative*. Alternatives to laboratory animals: ATLA, 1997. **26**(4): p. 481-503.
45. Henisch, H.K., *Crystal growth in gels*. Helvetica Physica Acta 1968. **41**(1): p. 888-897.
46. Patel, A. and A.V. Rao, *Crystal growth in gel media*. Bulletin of Materials Science, 1982. **4**(5): p. 527-548.
47. Robert, M. and F. Lefaucheux, *Crystal growth in gels: principle and applications*. Journal of Crystal Growth, 1988. **90**(1): p. 358-367.
48. Sperka, G., *Crystal growth in gels—a survey*. Progress in Colloid and Polymer Science, 1988. **77**: p. 207-210.
49. Natarajan, S., E. Rmachandran, and D.B. Suja, *Growth of some urinary crystals and studies on inhibitors and promoters. II. X-ray studies and inhibitory or promotory role of some substances*. Crystal Research and Technology, 1997. **32**(4): p. 553-559.
50. Kalkura, N. and S. Natarajan, *Crystallization from gels*, in *Springer Handbook of Crystal Growth*, D. Govindhan, et al., Editors. 2010, Springer-Verlag Berlin Heidelberg: New York.

51. Ahmed, S., M.M. Hasan, and Z. Alam, *In vitro urolithiasis models: An evaluation of prophylactic management against kidney stones*. Journal of Pharmacognosy and Phytochemistry, 2016. **5**(3): p. 28-35.
52. Kalkura, S.N. and S. Devanarayanan, *Growth of progesterone crystals in silica gel and their characterization*. Journal of Materials Science Letters, 1988. **7**(8): p. 827-829.
53. Kalkura, S.N. and S. Devanarayanan, *Crystal growth of steroids in silica gel: Testosterone*. Journal of Crystal Growth, 1989. **94**(3): p. 810-813.
54. Kalkura, S.N. and S. Devanarayanan, *Crystallization of steroids in gels*. Journal of Crystal Growth, 1991. **110**(1): p. 265-269.
55. Elizabeth, A., C. Joseph, and M. Ittyachen, *Growth and micro-topographical studies of gel grown cholesterol crystals*. Bulletin of Materials Science, 2001. **24**(4): p. 431-434.
56. Halberstadt, E.S., *Growth of single crystals of silver iodide in silica gel*. Nature, 1967. **216**(5115): p. 574.
57. Kratochvil, P., B. Sprusil, and M. Heyrovsky, *Growth of gold single crystals in gels*. Journal of Crystal Growth, 1968. **3-4**: p. 360-362.
58. Kurz, P.F., *Some chemical reactions in silica gels: III. Formation of potassium acid tartarate crystals*. The Ohio Journal of Science 1969. **69**(5): p. 296-304.
59. Glocker, D.A. and J.F. Soest, *Growth of single crystals of monobasic ammonium phosphate in gel*. The Journal of Chemical Physics, 1969. **51**(7): p. 3143.
60. George, M.T. and V.K. Vaidyan, *An electrolytic method to grow copper dendrites and single crystals in gels*. Kristall und Technik, 1980. **15**(6): p. 653-659.

61. Arora, S., *Advances in gel growth: a review*. Progress in Crystal Growth and Characterization, 1981. **4**: p. 345-378.
62. Arora, S. and T. Abraham, *Controlled nucleation of cadmium oxalate in silica hydrogel and characterization of grown crystals*. Journal of Crystal Growth, 1981. **52**(2): p. 851-857.
63. Bohm, J., *The history of crystal growth*. Acta Physica Hungarica, 1985. **57**(3-4): p. 161-178.
64. Bhavsar, D., *Growth of perfect and imperfect crystals in gel: A general view*. Advances in Applied Science Research, 2012. **3**(3): p. 1250-1254.
65. Ostwald, W., *Lehrbuch der allgemeinen Chemie*. Vol. 2. 1886: W. Engelmann.
66. Suib, S.L., *Crystal growth in gels*. Journal of Chemical Education, 1985. **62**(1): p. 81-82.
67. Liesegang, R., *Ueber einige eigenschaften von gallerten*. Naturwissenschaftliche Wochenschrift, 1896. **10**(30): p. 353-362.
68. Hatschek, E., *Die viskosität der dispersoide*. Colloid & Polymer Science (Kolloid-Zeitschrift und Zeitschrift für Polymere), 1911. **8**(1): p. 34-39.
69. Dreaper, W., *Reactions in aqueous and colloidal systems*. Journal of the Society of Chemical Industry, 1913. **32**(13): p. 678-684.
70. Holmes, H., *Formation of crystals in gels*. Journal of Franklin Institute, 1917. **184**(6): p. 743-773.
71. Davies, E.C.H., *Liesegang rings. III. The effect of light and hydrogen-ion concentration on the formation of colloidal gold in silicic acid gel. Rhythmic*

- bands of purple of cassius*. Journal of the American Chemical Society, 1923. **45**(10): p. 2261-2268.
72. Fells, H. and B. Firth, *Change of crystal structure of some salts when crystallised from silicic acid gel-The structure of silicic acid gel*. Proceedings of the Royal Society of London. Series A, Containing Papers of a Mathematical and Physical Character, 1926. **112**(761): p. 468-474.
73. Morse, H. and J. Donnay, *Calcite artificielle obtenue par diffusion dans un gel*. Bulletin de la Société Française de Minéralogie, 1931. **54**: p. 19- 23.
74. Plank, C., *Differences between silica and silica-alumina gels II. A proposed mechanism for the gelation and syneresis of these gels*. Journal of Colloid Science, 1947. **2**(4): p. 413-427.
75. Frank, F.C., *The influence of dislocations on crystal growth*. Discussions of the Faraday Society, 1949. **5**(0): p. 48-54.
76. Hektisch, H., J. Dennis, and J. Hanoka, *Crystal growth in gels*. Journal of Physics and Chemistry of Solids, 1965. **26**(3): p. 493-496.
77. Kurz, P.F., *Some chemical reactions in silica gels. I, Formation of mercuric iodide crystals*. Ohio Journal of Science, 1966. **66**(2): p. 198-209.
78. Kurz, P.F., *Some chemical reactions in silica gels II. Formation of crystals of a basic mercuric chloride, HgCl₂-2HgO*. Ohio Journal of Science, 1966. **66**(3): p. 284-311.
79. Dennis, J. and H.K. Henisch, *Nucleation and growth of crystals in gels*. Journal of The Electrochemical Society, 1967. **114**(3): p. 263-266.

80. Březina, B. and M. Havrankova, *Growth of KH_2PO_4 single crystals in gel*. Materials Research Bulletin, 1971. **6**(7): p. 537-543.
81. Banks, E., R. Chianelli, and F. Pintchovsky, *The growth of some alkaline earth orthophosphates in gelatin gels*. Journal of Crystal Growth, 1973. **18**(2): p. 185-190.
82. Bisailon, S. and R. Tawashi, *Growth of calcium oxalate in gel systems*. Journal of Pharmaceutical Sciences, 1975. **64**(3): p. 458-460.
83. Cody, R.D., *Growth and early diagenetic changes in artificial gypsum crystals grown within bentonite muds and gels*. Geological Society of America Bulletin, 1976. **87**(8): p. 1163-1168.
84. Březina, B., M. Havránková, and K. Dušek, *The growth of $PbHPO_4$ and $Pb_4(NO_3)_2(PO_4)_2 \cdot 2H_2O$ in gels*. Journal of Crystal Growth, 1976. **34**(2): p. 248-252.
85. Martin, S.A. and H. Haendler, *A modified diffusion apparatus for the growth of single crystals*. Journal of Applied Crystallography, 1978. **11**(1): p. 62.
86. Patel, A. and A.V. Rao, *An improved design to grow larger and more perfect single crystals in gels*. Journal of Crystal Growth, 1980. **49**(3): p. 589-590.
87. Arend, H. and J. Connelly, *Tetramethoxysilane as gel forming agent in crystal growth*. Journal of Crystal Growth, 1982. **56**(3): p. 642-644.
88. Lefauchaux, F., M. Robert, and E. Manghi, *A comparison between gel grown and solution grown crystals—case of ADP and KDP*. Journal of Crystal Growth, 1982. **56**(1): p. 141-150.

89. Barber, P.G. and N.R. Simpson, *A clarified gel for crystal growth*. Journal of Crystal Growth, 1985. **73**(2): p. 400-402.
90. Henisch, H. and J. Garcia-Ruiz, *Crystal growth in gels and Liesegang ring formation: I. Diffusion relationships*. Journal of Crystal Growth, 1986. **75**(2): p. 195-202.
91. Henisch, H.K., "Growth waves" in periodic precipitation. Journal of Crystal Growth, 1988. **87**(4): p. 571-572.
92. Cipanov, A., L. Goshka, and V. Ruzov, *Crystal growth in gel: Investigation of nucleation processes*. Crystal Research and Technology, 1990. **25**(7): p. 737-746.
93. Chernavskii, D., A. Polezhaev, and S. Müller, *A model of pattern formation by precipitation*. Physica D: Nonlinear Phenomena, 1991. **54**(1): p. 160-170.
94. Plovnick, R.H., *Crystallization of brushite from EDTA-chelated calcium in agar gels*. Journal of Crystal Growth, 1991. **114**(1): p. 22-26.
95. Kalkura, S.N., et al., *Crystallization of uric acid*. Journal of Crystal Growth, 1993. **132**(3): p. 617-620.
96. Irusan, T., et al., *Dendritic structures of brushite in silica gel*. Journal of Crystal Growth, 1993. **130**(1-2): p. 217-220.
97. Chopard, B., P. Luthi, and M. Droz, *Microscopic approach to the formation of Liesegang patterns*. Journal of Statistical Physics, 1994. **76**(1-2): p. 661-677.
98. Girija, E., S.N. Kalkura, and P. Ramasamy, *Crystallization of cystine*. Journal of Materials Science: Materials in Medicine, 1995. **6**(11): p. 617-619.

99. Srinivasan, N. and S. Natarajan, *Growth of some urinary crystals and studies on inhibitors and promoters. I. Standardisation of parameters for crystal growth and characterization of crystals*. Indian Journal of Physics 1996. **70**: p. 563-568.
100. Garcia-Ruiz, J., et al., *Role of gravity in the formation of Liesegang patterns*. The Journal of Physical Chemistry, 1996. **100**(21): p. 8854-8860.
101. Sivakumar, G., et al., *Crystallization and characterization of calcium phosphates: brushite and monetite*. Crystal Research and Technology, 1998. **33**(2): p. 197-205.
102. Ramachandran, E. and S. Natarajan, *Crystal Growth of some urinary stone constituents: I. In-vitro crystallization of L-Tyrosine and its characterization*. Crystal Research and Technology, 2002, **37**(11): p. 1160-1164.
103. Ramachandran, E. and S. Natarajan, *Crystal growth of some urinary stone constituents: II. In-vitro crystallization of hippuric acid*. Crystal Research and Technology, 2002. **37**(12): p. 1274-1279.
104. Joshi, V.S. and M.J. Joshi, *FTIR spectroscopic, thermal and growth morphological studies of calcium hydrogen phosphate dihydrate crystals*. Crystal Research and Technology, 2003. **38**(9): p. 817-821.
105. Ramachandran, E. and S. Natarajan, *Crystal growth of some urinary stone constituents: III. In-vitro crystallization of L-cystine and its characterization*. Crystal Research and Technology, 2004. **39**(4): p. 308-312.
106. Kalkura, S.N., et al., *Investigations on the synthesis and crystallization of hydroxyapatite at low temperature*. Bio-medical Materials and Engineering, 2004. **14**(4): p. 581-592.

107. Ramachandran, E. and S. Natarajan, *Growth habits of hippuric acid in gel*. Crystal Research and Technology, 2005. **40**(8): p. 765-767.
108. Joshi, V., et al., *Herbal extracts of Tribulus terrestris and Bergenia ligulata inhibit growth of calcium oxalate monohydrate crystals in vitro*. Journal of Crystal Growth, 2005. **275**(1): p. e1403-e1408.
109. Sundaramoorthi, P. and S. Kalainathan, *Crystal growth of some renal stones constituents: I. In vitro crystallization of trace element and Its characterization studies*. Journal of Minerals and Materials Characterization and Engineering, 2007. **6**(01): p. 17-24.
110. Kanchana, G., et al., *Nucleation reduction strategy of (Brushite) CHP crystals in SMS media and its characterization studies*. Journal of Minerals and Materials Characterization and Engineering, 2008. **7**(1): p. 49-57.
111. Chauhan, C.K., et al., *Growth and characterization of struvite crystals*. Indian Journal of Pure & Applied Physics, 2008. **46**(7): p. 507-512.
112. Chauhan, C. and M. Joshi, *Growth inhibition of Struvite crystals in the presence of juice of Citrus medica Linn*. Urological Research, 2008. **36**(5): p. 265-273.
113. Parekh, B., M. Joshi, and A. Vaidya, *Characterization and inhibitive study of gel-grown hydroxyapatite crystals at physiological temperature*. Journal of Crystal Growth, 2008. **310**(7): p. 1749-1753.
114. Parekh, B., et al., *In vitro growth and inhibition studies of monosodium urate monohydrate crystals by different herbal extracts*. American Journal of Infectious Diseases 2009. **5**: p. 232-237.

115. Chauhan, C., M. Joshi, and A. Vaidya, *Growth inhibition of struvite crystals in the presence of herbal extract Commiphora wightii*. Journal of Materials Science: Materials in Medicine, 2009. **20**(1): p. 85-92.
116. Madhurambal, G., R. Subha, and S. Mojumdar, *Crystallization and thermal characterization of calcium hydrogen phosphate dihydrate crystals*. Journal of Thermal Analysis and Calorimetry, 2009. **96**(1): p. 73-76.
117. Rajendran, K. and C. Dale Keefe, *Growth and characterization of calcium hydrogen phosphate dihydrate crystals from single diffusion gel technique*. Crystal Research and Technology, 2010. **45**(9): p. 939-945.
118. Valarmathi, D., L. Abraham, and S. Gunasekaran, *Growth of calcium oxalate monohydrate crystal by gel method and its spectroscopic analysis*. Indian Journal of Pure Applied Physics, 2010. **48**: p. 36-38.
119. Choubey, A., *In vitro growth and inhibition studies of Ceiba pentandra on monosodium urate monohydrate crystals*. Pharmacology online, 2011. **2**: p. 650-656.
120. Kesavan, M., et al., *In vitro evaluation of calcium oxalate monohydrate crystals influenced by Costus igneus aqueous extract*. Scandinavian Journal of Urology and Nephrology, 2012. **46**(4): p. 290-297.
121. Salim, M.A., *The characteristics, dielectric properties and surface morphology of calcium oxalate monohydrate single crystals grown in silica gel*. Journal of Chemical, Biological and Physical Sciences (JCBPS), 2012. **2**(2): p. 962-967.

122. Diana, K. and K. George, *In-vitro studies on antilithiatic property of Achyranthes aspera L. var. aspera. Hook. f.* Journal of Pharmacy Research, 2012. **5**(8): p. 4366-4370.
123. Chauhan, C.K. and M.J. Joshi, *In vitro crystallization, characterization and growth-inhibition study of urinary type struvite crystals.* Journal of Crystal Growth, 2013. **362**: p. 330-337.
124. Vasuki, G. and R. Selvaraju, *Growth and characterization of uric acid crystals.* International Journal of Science and Research, 2014. **3**(8): p. 696-699.
125. Suryawanshi, V. and R. Chaudhari, *Growth and study of micro-crystalline calcium oxalate monohydrate crystals by agar gel system.* Archives of Physics Research, 2014. **5**(2): p. 38-44.
126. Suryawanshi, V.B. and R.T. Chaudhari, *Growth and characterization of agar gel grown brushite crystals.* Indian Journal of Materials Science, 2014: p. 6.
127. Suryawanshi, V.B. and R.T. Chaudhari, *Synthesis and characterization of Struvite-k crystals by agar gel.* Journal of Crystallization Process and Technology, 2014. **4**(04): p. 212-224.
128. Suryawanshi, V. and R. Chaudhari, *Effect of gel parameters on nucleation and growth of brushite crystals in agar-agar gel.* Weekly Science Research Journal, 2015. **3**(25): p. 1-5.
129. Popalghat, S. and A. Bhagat, *The study of crystal growth of whewellite in gel media.* International Journal of Recent Scientific Research, 2015. **6**(2): p. 2587-2589.

130. Ahmed, S., M. Hasan, and Z. Mahmood, *In vitro microscopic study of monosodium urate monohydrate crystals growth patterns*. Journal of Pharmaceutical and Scientific Innovation, 2015. **4**(6): p. 295-297.
131. Bindhu, B., A. Swetha, and K. Veluraja, *Studies on the effect of Phyllanthus emblica extract on the growth of urinary type struvite crystals invitro*. Clinical Phytoscience, 2015. **1**: p. 3.
132. Joshi, V., *Effect of supernatant solutions on the formation of Liesegang rings*. International Journal of Innovative Research in Science, Engineering and Technology, 2016. **5**(1): p. 1027-1031.
133. Selvaraju, R. and S. Sulochana, *In-vitro growth and inhibition studies of Tribulus terrestris on calcium oxalate monohydrate crystals*. International Journal of Science and Research, 2016. **5**(6): p. 83-87.
134. Muryanto, S., S. Sutanti, and M. Kasmiyatun, *Inhibition of struvite crystal growth in the presence of herbal extract Orthosiphon aristatus BL. MIQ*. MATEC Web of Conferences, 2016. **58**: p. 01013.
135. Nasir, E. and S.I. Ali, *Flora of Pakistan*. Vol. 100 Papilionaceae. 1977. 1-389.
136. Aniszewski, T., A.-L. Karttunen, and H. Hyvarinen, *Structure of Phaseolus lunatus testa at its central point*. Acta Biologica Cracoviensia Series Botanica, 2006. **48**(1): p. 69-76.
137. Chauhan, J., et al., *Morphology and influence of various plant growth substances on germination and early seedling growth in Macrotyloma uniflorum (Lam.)*. Journal of American Science, 2009. **5**(6): p. 43-50.

138. Giurcă, D., *Morphological and phenological differences between the two species of the Phaseolus genus (Phaseolus vulgaris and Phaseolus coccineus)*. Cercetari Agronomica in Moldova, 2009. **42**(2): p. 39-45.
139. Das, I., et al., *In vitro inhibition and dissolution of calcium oxalate by edible plant Trianthema monogyna and pulse Macrotyloma uniflorum extracts*. Journal of Crystal Growth, 2005. **273**(3): p. 546-554.
140. Murray, M.T. and J. Pizzorno, *The Encyclopedia of Natural Medicine Third Edition* 2012, New York: Simon and Schuster Incorporation.
141. Duke, J.A., *Duke's handbook of medicinal plants of Latin America* 2008, Boca Raton, Florida.: Taylor & Francis Group, LLC.
142. Johri, N., et al., *An update and practical guide to renal stone management*. Nephron Clinical Practice, 2010. **116**(3): p. c159-c171.
143. Basavaraj, D.R., et al., *The role of urinary kidney stone inhibitors and promoters in the pathogenesis of calcium containing renal stones*. EAU-EBU update series, 2007. **5**(3): p. 126-136.
144. Reungjui, S., et al., *Magnesium status of patients with renal stones and its effect on urinary citrate excretion*. BJU International, 2002. **90**(7): p. 635-639.
145. Grases, F. and A. Costa, *Phytate (IP6) is a powerful agent on preventing calcification in biological fluids. Usefulness in renal lithiasis treatment*. Anticancer Research, 1999. **19**(5): p. 3717-3722.
146. Selvam, R., *Calcium oxalate stone disease: role of lipid peroxidation and antioxidants*. Urological Research, 2002. **30**(1): p. 35-47.

147. Huang, H.-S., et al., *Lipid peroxidation and its correlations with urinary levels of oxalate, citric acid, and osteopontin in patients with renal calcium oxalate stones.* Urology, 2003. **62**(6): p. 1123-1128.
148. Grases, F., et al., *Phytotherapy and renal stones: the role of antioxidants. A pilot study in Wistar rats.* Urological Research, 2009. **37**(1): p. 35-40.

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