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Research Article

IN VITRO MICROSCOPIC STUDY OF MONO SODIUM URATE MONOHYDRATE CRYSTALS GROWTH PATTERNS

Salman Ahmed [1], Muhammad Mohtasheemul Hasan [1]* and Zafar Alam Mahmood [2]
[1]Department of Pharmacognosy, Faculty of Pharmacy, University of Karachi, Karachi, Pakistan
[2]Colorcon Limited – UK, Flagship House, Victory Way, Crossways, Dartford, Kent, DA26 QD England
*Corresponding Author Email: mohassan@uok.edu.pk

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ABSTRACT

The purpose of the study is to explore the possible morphological features of mono sodium urate monohydrate crystals. The study was carried out on a glass slide under microscope to observe the growth patterns. As a result, three types spherical ring banded, dumbbell and composite spherulites were observed. This study gives a detailed information about the morphology and aggregation patterns of mono sodium urate monohydrate crystals.

Keywords: Uric acid, crystallization, mono sodium urate, microscopic study, gouty arthritis, urolithiasis.

INTRODUCTION

Uric acid is used by reptiles and birds as a means to eliminate excess nitrogen, although for lower mammals. It is simply a byproduct of purine metabolism and is excreted in the urine after conversion into allantoin by the enzyme uricase. This enzyme has been lost in the evolution of higher primates, including humans, suggesting that a relatively hyperuricemia bestows some survival or reproductive advantage. However, despite these potential benefits, uric acid may be a prime player in some noxious processes such as gout and nephrolithiasis[1]. Crystals of uric acid as well its sodium salts have been found in the renal tract, interstitial tissues of the kidney and in its collection ducts. Uric acid is also often found as a constituent of urinary calculi and has a high incidence in nephrolithiasis resulting in severe kidney damage[2-4]. Uric acid monohydrate[5] and uric acid dihydrate[6] are the components of uric acid urinary calculi. The present study was carried out on a glass slide by using reagents of single diffusion gel technique[7,8] to observe the growth habits of mono sodium urate monohydrate (MSUM) crystals. The present microscopic study of mono sodium urate crystal growth has not been published elsewhere in any journal or other citable form.

MATERIALS AND METHODS

Apparatus and Instruments

Nikon Eclipse E 400 binocular microscope, Japan ; Ricoh CX4 Digital Camera, Japan ; Microscope slides 25.4 x 76.2 (1 " x 3 ") Universal Health Care Products, China ; Whatman filter paper # 02, Whatman International Ltd., England.

Chemicals and Reagents used

Acetic acid (glacial) 100 % anhydrous, sodium hydro oxide, sodium silicate solution (Merck, Germany), uric acid crystalline (Sigma-U2625) (Sigma-Aldrich Chemie, Switzerland).

Method of crystal growth

The different stages of the growth of mono sodium urate monohydrate (MSUM) crystals were studied under compound microscope. Crystals were grown on glass slide at 26 ± 2 °C. A drop of gel media (pH 5.02 - 5.17) was put at the mid of glass slide. Gel media (sodium meta silicate solution + 0.2M sodium hydroxide + 2N acetic acid) allowed to convert into good quality gel. Gel formation occurs in 05 mins. Single drop of 0.07 M uric acid was dropped at properly formed gel. The glass slide was observed under microscope till it was completely dried.

RESULTS AND DISCUSSION

The observations of mono sodium urate monohydrate MSUM crystals (spherulites) formation were made under 10x magnification till the complete formation of spherulites (43mins). spherulites grow in a free manner. They remain perfectly spherical as long as they didn't get in touch with each others, they convert into dumbbell shape. Whereas more than two spherulites joined with each other to form composites. Spherical ring banded single spherulites, dumbbell and composite spherulites were observed. Spherulites continue to grow under same fashion till fill out the entire surface.

MSUM is the salt of singly ionized state of uric acid. Nephropathy of uric acid and urate substances is associated with the formation of monosodium urate monohydrate (MSUM), ammonium urate and uric acid in the urinary tract system. The MSUM of vesical origin is not only observed in renal calculi, but also acts as an effective promoter of calcium oxalate crystallizations[9]. The main sites of urate crystallization are articular cartilage, periarticular soft tissues, bursae, epiphyseal bone and kidneys. The presence of characteristic needles or spherulite form of spherulite crystals MSUM in synovial fluid and within the synovial leucocytes is recognized as a strong indication of the gouty arthritis[10].

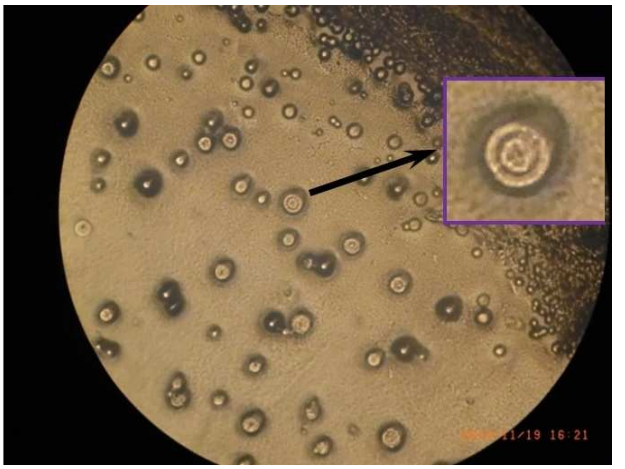

Figure 1.1: Formation of MSU crystals - Spherical ring banded single spherulites are enlarged

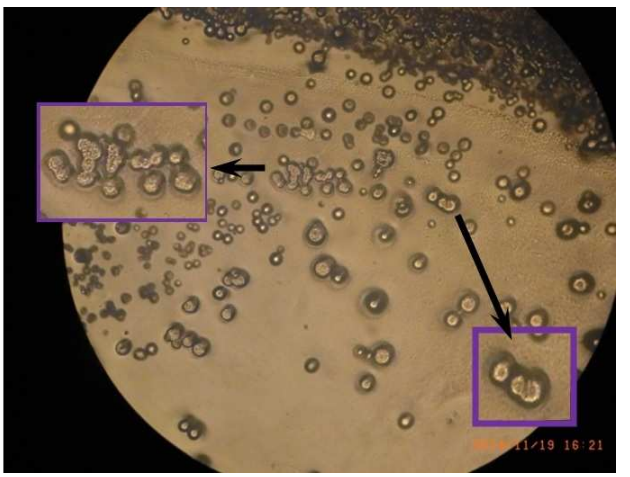

Figure 1.2: Formation of MSU crystals - dumbbell and composite spherulites are enlarged.

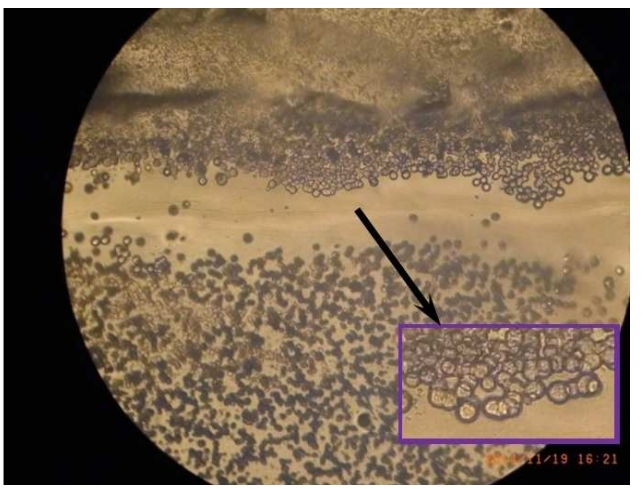

Figure 1.3: Formation of MSU crystals - aggregated composite spherulites are enlarged.

CONCLUSION

Mono sodium urate monohydrate is formed as spherical ring banded spherulites, dumbbell and composite spherulites. It was a preliminary study and doesn't have any quantitative and statistical analysis. Now, the authors are looking forward to focus different other scientifically based authentic aspects of the same study.

REFERENCES

1. Moe OW. Uric acid nephrolithiasis: proton titration of an essential molecule? Curr Opin Nephrol Hypertens,2006; 15: 366-373.
2. Ringertz H. Optical and crystallographic data of uric acid and its dihydrate. Acta Cryst, 1965; 19: 286-287.
3. Sutor D & Scheidt S. Identification standards for human urinary calculus components, using crystallographic methods. Brit J Urol, 1968; 40: 22-28.
4. Rinaudo C & Boistelle R. The occurence of uric acids and the growth morphology of the anhydrous monoclinic modification: C 5 H 4 N 4 O 3. J Cryst Growth, 1980; 49: 569-579.
5. Schubert G, Reck G, Jancke H, Kraus W, Patzelt C. Uric acid monohydrate—a new urinary calculus phase.Urol Res, 2005; 33: 231-238.
6. Hesse A, Schneider H, Berg W, Hienzsch E. Uric acid dihydrate as urinary calculus component. Invest Urol, 1975; 12: 405-409.
7. Parekh B, Vasant SR, Tank KP, Raut A, Vaidya A, Joshi, M. J. In vitro growth and inhibition studies of monosodium urate monohydrate crystals by different herbal extracts. Am J Infect Dis, 2009; 5: 232-237.
8. Choubey A. In vitro growth and inhibition studies of Ceiba pentandra on Monosodium Urate Monohydrate crystals. Pharmacologyonline, 2011; 2: 650-656.
9. Grover PK, Marshall VR, Ryall RL. Dissolved urate salts out calcium oxalate in undiluted human urine in vitro: implications for calcium oxalate stone genesis. Chemistry & Biology, 2003; 10: 271-278.
10. Kalkura SN, Girija E, Kanakavel M, Ramasamy P. 1995. In-vitro crystallization of spherulites of monosodium urate monohydrate. J Mater Sci Mater Med, 6: 577-580.

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