In Vitro Growth of Kidney Stone – A Short Review

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Abstract : ***The increased salinity in the coastal area has found larger impact on the nearby civilization. The health of the human beings are also the affected by the salinity extended up to ground water. The one of the salinity impact is the crystal growth in the form of kidney stone. It is the urological disorder which found most painful among the all urological diseases. The present article provides the detailed study of the growth of this naturally grown crystal and some experimental evidence of in vitro growth of this type of painful crystals. The core idea of the work is to provide a single document for the researches working in the same field.***

IndexTerms – Kidney.Stone, In vitro, Crystallization.

I. INTRODUCTION

The race for the development has been the inbuilt nature of mankind since early age. The goals set for extreme development have been achieved at the cost of environment degradation. The large decrease in the mangroves and other green cover has been observed since last ten years. As a result the coastal and desert areas have been extended up to thousand of kilometer area of the fertile land. The ground water quality is gradually decreasing. The turbidity, odor, taste and the hardness are the main physical quality parameters affected. The salinity of the any water body may rise because of ion catching through marine water, filtration of soil, excessive extraction of ground water for irrigation [1-2].

Occurrence of the kidney stone has been increased in the urinary tract of not only human beings but also that of some animals [3]. The deposition of the some salts in the form of crystal is known as the kidney stone or the urinary calculi [4]. Many study of the artificial growth (in vitro) have been reported with different types of component observed in the real kidney stone [5-15].

It will be worthy to study the various types of crystallization process done in the laboratory which ultimately resembles as in the organs of human or animals. The formation of such crystals can provide the overall idea about the disease occurrence. The affecting parameters can be identified through the laboratory exercise. The detection and controlled mechanism can be developed for the stone growth in real form. With the above motivation following sections discussed some facts and presents previously reported works. The comparison among them also made wherever required.

The pain of the disorder to the patient is found very sever. The span of the age is not limited to the victim. It may target the any person of any age. Female as well as male both may suffer from the said disease. Thus there is no limitation in the age or sex group for this physical problem. Further the reducing water quality and the food intake with lots of metallic impurity are also the cause of the disease. The long time intervals of deposition may give rise to the other infections and other problems related to urinary track.
It is observed the size of the stone may vary from mm to cm. it also be found that it may created in small groups rather than single point deposition. This may increase the complexity of the removal of the stone. The techniques which are employed are the physical surgery removal treatment over kidney. It is costlier as well as may sometime difficult for the patient of diabetes. Therefore the there is a sever demand to have a proper knowledge and database regarding the said problem. It will be very fruitful to grow the similar type of stone outside the body and studied comprehensively. Various researchers working in this field are trying to provide as much as possible outcomes in this field to improve the present treatment. There are several process developed and reported to create the exact similar process as taken place in the living organs inside the body. There are several types of crystal which are found as a stone are grown in the laboratory. They are also analyzed for various properties. The outcome of each of them can be applicable to according to the condition of the patient. Some precautionary actions can also be extracted by which the development of the stone can be prevented or stopped. The prediction regarding the size increase also can be done with the help of the analysis of the results done in the laboratory in vitro experiments.

II. IN VITRO GROWTH OF CRYSTALS

The required environment and solution is to be prepared in laboratory to support the process. The process may have a wide area of selection of the material as many types of salts have been reported under the diagnostic test of the stone. Struvite is one of the familiar forms of the material observed in the stones. Struvite is basically ammonium magnesium phosphate hexahydrate $\left(NH_4MgPO_46(H_2O)\right)$. It is one of the observed type kidney stone having a 30% of total occurrence of the stone world wild [16].

Chauhan *et al.* [3] has grown the struvite by allowing the diffusion of gel used their experiment. Various concentration C wightii were provided in slots. From their study the found the significant decrease in the crystal growth rate and dimensions with the change in the concentration of juice of herbal extract C. wightii used during the process.

Calcium oxalate and calcium phosphate are also detected as the form of kidney stones. There is als a probability of the mixed type of material i.e. oxalate and phosphate. Apatie $(Ca_{10}(PO_4)_6(OH)_2)$ and brushite $(CaHPO_4, 2H_2O)$ are the forms available of the said crystals. Calcium hydrogen phosphate dihydrate is another type of crystal also found many time in the urinary track.

Joshi [17] has used reported the growth and characterization of the calcium hydrogen phosphate dihydrate. They obtained needle and platelet in their final yield.

The synthesis and charectrisation of Magnesium based crystal $MgNH_4PO_4.6H_2O$ were studied by Maniciu *et al.* [18]. The process was done under the environment of herb *Rotula Aquatica Lour (RAL).* Some spectroscopic investigation presented through the artcle [18]. Especially, the factors affecting the rate of growth were suggested. The presence of the Zn found to be the accelerator of the yielding.

The exact knowledge of the properties and affected parameters are required for the therapeutic and diagnostic process of the rinal calculi. The recent techniques involve various types of chemical processes for the study of stone. But most of them are destructive and hence many of the unfocused properties remain unclear and hidden. In this regards some techniques also developed for the said study that includes the application of various herbal plants. The schematic of process is shown in the **Fig. 1**

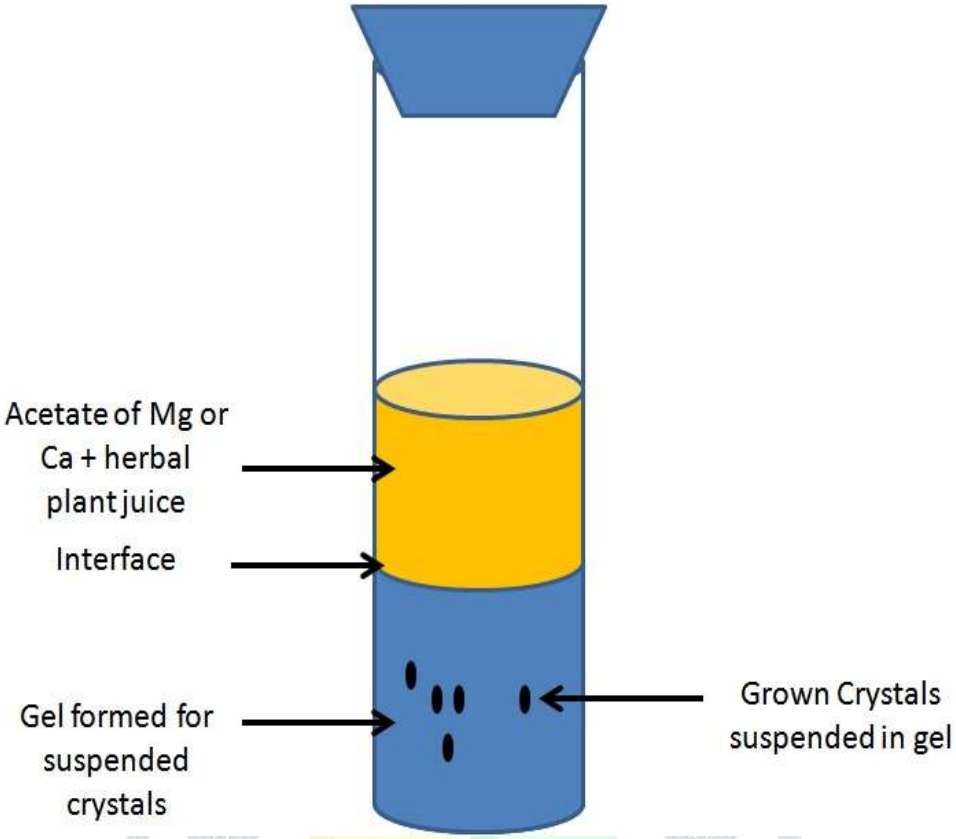

Figure 1. Schematic of the process for crystal growth.

In the same line, Prasad et al. [19] reported the use of Ammania baccifera for magnesium and calcium kidney stone. Homonia riparia was used by Prasad et al. as reported in their article [20]. Mimosa pudica was used by Joyamma et al. [21] to study the Zinc disc –induced kidney stone. Selvam et al [22] has reported the plant of Aerva lanata for their work.

In almost all study the decreasing rate of the crystal growth under study observed. It can be consider as one positive indication in the medical science because it can be further developed for the therapeutic applications and prevention and control tool.

III. Conclusions

The study of the various types of in vitro growth of rinal calculi has been done. It can be concluded that it is possible to control the rate at which the kidney stone can grow inside the urinary track of humans as well as animals. Depending upon the environment provided to the process the size also can be maintained. Thus it is possible to prevent or control the stone growth. The present article plays an important role in deciding the treatment procedure for the urinary disordered under the study.

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