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Scanning Electron Micrscopic Structural Studies on Diatoms

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Abstract: Diatom is single-celled eukaryote belonging to the division of *Bacillariophyta*. The cell walls are composed of silica. They are important component distributed in phytoplankton, ponds, rivers and most of the marine ecosystems. Structural studies on diatoms are not enough, because of their very small size. The incredible development of diatom nanotechnology is due to the structural properties of diatoms. Diatoms samples were collected from Bharathidasan University campus, Tiruchirappalli, India and studied using both light and scanning electron microscopy and identified as *Stauroneis* sp., The SEM studies showed fine nanostructure pores, girdle and valve view and raphe very legibly. The present study was deals with the structural properties of the isolated diatom, *Stauroneis* sp which will pave the way for further utilization and applications in diatom nanotechnology.

Key words: *Bacillariophyceae* · *Stauroneis* sp. girdle view · SEM · Nanostructures

INTRODUCTION

Diatoms are either free-floating, planktonic forms or attached to a substrate, benthic forms. Individual diatoms ranges from 2μm to 1mm in size, they are very diverse with 60000 species reported [1, 2]. They have special characteristics structure called frustules or diatom shell. The protoplast is surrounded by a silicate wall which is in two pieces, fitted like the two halves of soap box. These silicate walls, frustules, are very well preserved as fossils and are found extensively as diatomaceous earth [3]. Although their ecological importance is evident, the taxonomy of the genus is confused and surrounded by considerable controversy [4]. It is well known that the diatoms are influenced by different parameters in their distribution and many workers have recorded such as temperature, pH, light intensity and the percentage of necessary nutrients.

Earlier researchers has confused with diatom that the frustules being made up of silica, were thought to be non-porous and it become difficult to explain how absorption of nutrients from the environments could take place through such a non-porous walls. Later on, the contribution of scanning electron microscopic studies is the knowledge that these frustules have regularly arranged pores and such they open to exchange of nutrients. This work may explore the unexplored fine structure of the diatoms to current research interest and classical taxonomy.

MATERIALS AND METHODS

Diatom samples were collected from ponds in Bharathidasan University campus, Tiruchirappalli, India. The samples were transferred in F/2 medium and alternative illumination was given (12h/12h light and dark). After the incubation period, small amount of diatoms samples collected and washed with distilled water twice finally centrifuged at 2000 rpm for 5 min. The samples were observed in light microscopy and scanning electron microscopy after the cleaning of cells already described [5]. Briefly, the diatom samples were boiled with hydrogen peroxide, this acid solution was removed by washing with distilled water. The diatom samples were placed in carbon grid coated with gold and observed in Scanning electron microscope (JEOL – JSM-5210).

RESULTS AND DISCUSSION

The topography of the diatom cells were observed in low power and high power magnification in light and scanning electron microscopy respectively and the diatom was identified as *Stauroneis* sp., which belongs to the family *Stauroneidaceae* and order of *Naviculales*. Light microscopic observation of *Stauroneis* sp., showed with pigments in valve view (Fig 1.). The diatom cells showed external girdle view and valve view (Fig. 2). The girdle view of *Stauroneis* sp. observed in two-dimensional views was about 5μm in diameter (Fig 3.) and in the valve

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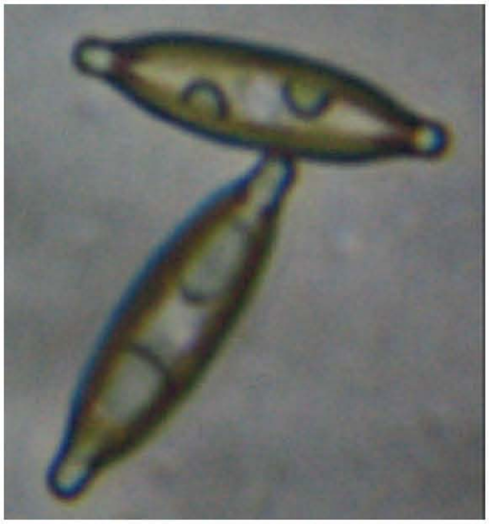

Fig. 1: Light Microscopic observation of a diatom, *Stauroneis* sp. in valve view

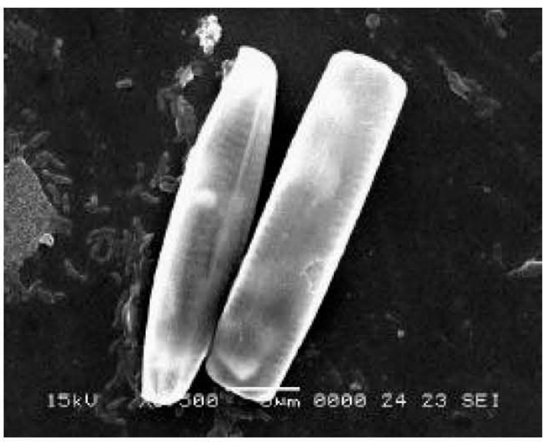

Fig. 2: Scanning Electron Microscopic view of a diatom, *Stauroneis* sp. both gridle and valve view

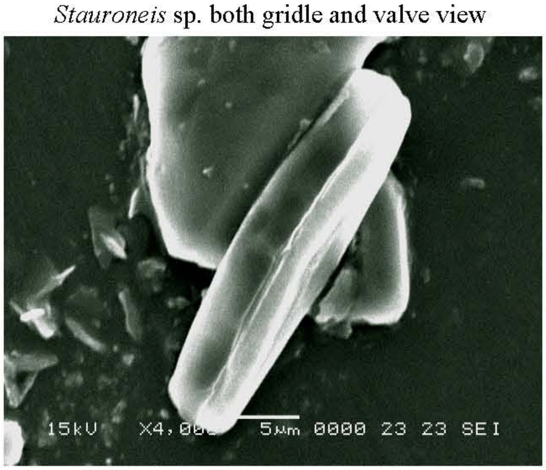

Fig. 3: Scanning Electron Microscopic view of a diatom, *Stauroneis* sp. it showed two dimentional view clearly

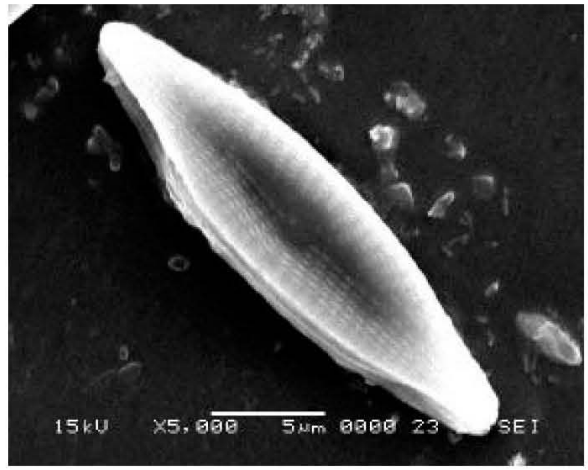

Fig. 4: The regularly arranged pores observed in frustular structure in *Stauroneis* sp., using SEM

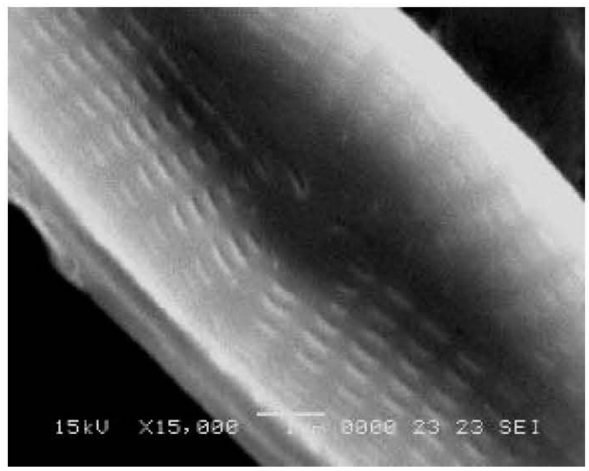

Fig. 5: Scanning Electron Microscopic view of a diatom, *Stauroneis* sp. it showed nanometer sized pores ranges from 150nm-200nm

view frustules with regularly arranged pore (Fig. 4). Despite the high resolution offered by TEM, the introduction of scanning electron microscopy has had a more profound impact on diatom taxonomy [6]. SEM has allowed phycologists to appreciate the three-dimensional structure of diatom valves and the highly characteristic architecture of the silica shell [7, 8, 9].

Both the epivalve and hypovalve possess a valve mandle, valvocopula and one to several intercalary bands. The girdle bands are present at midvalve and apparently function to hold the valve together. At higher magnification, these valvar features were observed in even greater detail. This technique may also be employed in the examination of extracellular, nonsiliceous components such as attachment stalks and mucilage secretions [10]. When examine in SEM, the transapical section appeared extremely clear with a perfect cutting plane through the diatom frustules [11].

The nanometer sized pores were observed in *Stauroneis* sp., in the size range of 150- 200nm (Fig. 5). The gaps between regularly arranged pores were 200nm was clearly observed. The incredible development in diatom nanotechnology and material science, the diatom cell wall were placed a key role in the synthesis of nanocomposites were described using pinnate and centric diatoms [12]. Briefly, incorporation of germanium metals in to silicon for the synthesis of Si-Ge nanocomposites and metal oxides. The distance between the striae and the pores measured along with the striae in different diatoms in the size ranges from 263-271nm is described (Data not shown). This study enables to know the structural studies of the diatom, *Stauroneis* sp. for the exploration of nanostructures present in the diatom.

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