



University of  
Massachusetts  
Medical School

**Barur R. Rajeshkumar PhD**  
Senior Research Scientist

Cardiovascular Medicine ASC7-1007  
University of Massachusetts Medical School  
368 Plantation Street, Worcester, MA 01605  
508.856.6225 (office) 508.340.3127 (cell)  
Email: barur.rajeshkumar@umassmed.edu

### EXAMINER'S REPORT ON Mrs. REVATHY's PHD THESIS:

"COMPARATIVE STUDIES ON TEXTILE DYE WATER TREATMENT BY PHYTOREMEDIATION ADSORBENT (DRIED ROOT POWDER *Eichhornia crassipes*) AND BIOREMEDIATION (*Pseudomonas vesicularis*) REUSED FOR AQUACULTURE AND AGRICULTURE".

**I RECOMMEND THAT THE CANDIDATE BE AWARDED THE DEGREE OF DOCTOR OF PHILOSOPHY  
IN ZOOLOGY WITHOUT FURTHER EXAMINATION.**

The candidate, Mrs. Revathy, has chosen a socially relevant topic for her research study. The aim of this doctoral research study is to employ three different methods in order to eliminate the color and pollutants in the textile industry's dye effluent water which was disposed with or without any treatment. These textile effluents were treated further with low-cost, locally available Phytoremediation adsorbent and bioremediation techniques; this treated waste water were used in Aquaculture, and the fish cultured waters were purified enough to use in agriculture processes.


Textile industry plays an important role in the economy of a country like India because it accounts for approximately one third of the country's total export. Due to the relaxed regulation, cost to treat of textile effluent and several other factors, textile industries overlooks the disposal of the dye effluents into rivers, lakes, and oceans. This contributes to the environmental pollution and jeopardizes the health and welfare of the people. Several phytoremediation processes have also been adopted by many researchers for removing color and heavy metal from industrial effluent. A very promising area for removing color from textile is biological treatment that breaks down the

A handwritten signature in black ink, appearing to read 'B. R. Rajeshkumar', followed by a long horizontal flourish.

dye molecules to basic elements. Biosorption is yet another mode of removing pollutants from waste waters employing either living or dead biomass. Considering the environmental pollution and the health hazard to the population, there is a need to treat the textile dye waste water before it is discharged into the any water bodies.

In this present investigation, the candidate used three different mode of treatment for effective removal of color and heavy metal compounds from textile dye waste water .The work was carried up to 45 days at the interval of 15 days. Overall from the results, the color removal efficiency was highest by dried root powder [*Eichhornia* plant] followed by live plant and biomass [*P. vesicularis*]. The metal reduction from the textile dye effluent by three treatments was also well established by *E. crassipes* especially heavy metals like Copper, Zinc, and Cadmium and Nickel and Lead by *P. vesicularis*. Treated textile effluents were used as a source for fish culture, and the used fish culture water was reused for the cultivation of *Sorghum bicolor*. The treated waste water showed very good survival of the fish population and the biochemical parameters analysis proved to be encouraging. The water was reused for agriculture to check the germination, growth, and biochemical parameters of *Sorghum bicolor* also encouraged and exhibited soil organic carbon content, improved the nutrient levels compared to untreated textile dye waste waters. Mrs. Revathy concluded that the live plant *E. crassipes* was much efficient in the removal of pollutants from the textile effluents and these methods are cost-effective and eco- friendly compare to various other textile effluent treatment method.

This examiner finds this research study represents an exceptional piece of work. This research study was well thought-out and executed with a great extent. The literature review encompasses a wide range of key issues in textile effluent, Phytoremediation and Bioremediation in an authoritative, critical and well-informed manner. The rationale for the study itself is explained clearly, and the investigation is carried out with a high degree of rigorous, in accordance with



current standards of good practice for research in this field. The methodology applied is clear and organized in a sequence to address the goal of the planned research study to evaluate the effect of these three remedial methods to eliminate the potential toxic materials present in the textile dye effluents. Results and discussion were presented well to establish the effectiveness of these effluent treatments. The results obtained are adequate, and the data obtained is discussed in the light of relevant available literature. The results are clearly presented in the form of tables, figures and graphs. The statistical analysis has been carried out to present the significance. This research lays a strong basic foundation for the researchers, scientists, industrialists and politicians, who may have to further understand, analyze, and take necessary steps to make use, develop and find a newer and much effective treatment for this devastating issue.

The candidate has already made some abstracts and presentations from the thesis. However, it is a fertile source for many further publications both within and outside India. I would urge the student to move toward publication in leading peer reviewed journals.

In summary, this study was well planned, efficiently organized, well-written and the style and layout are excellent. This study is original and significant contribution to knowledge and understanding of evaluating the textile effluent treatment options and this thesis meets the required standard of a doctoral thesis to justify the award of a PhD.

## **Conclusion**

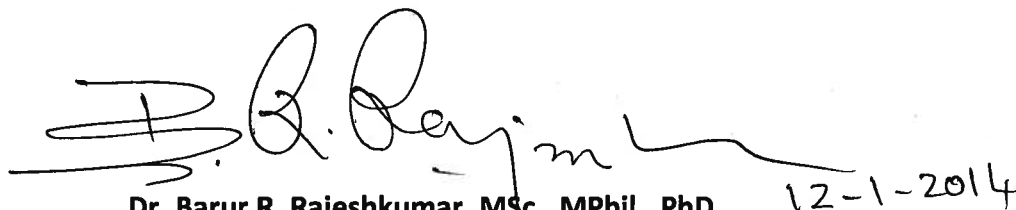
The submitted thesis fulfils the requirements for a doctoral thesis, both in terms of theoretical - methodological level, so the usefulness in practice. The thesis contains the original results. I recommend the thesis to the defense before the relevant commission. Based on the thesis, I suggest the academic and scientific degree "Doctor Philosophy in Zoology", Periyar University, India to confer to Mrs. Revathy after successfully defending of his thesis.



A few specific comments may, however, be directed at the candidate during viva interface:

**Questions may be asked during viva voce:**

1. The findings of this work suggest that dried root powder [Eichhornia plant] treatment effectively removes the color and the heavy metal compounds from textile dye waste water. This is feasible for a small scale laboratory testing. How this will be applied to the large amount of waste water. Assuming, one could store the water in a tank or other means, then treat with Eichhornia plant dry powder? Can you produce the root powder to meet the need? Alternatively, what compound or chemical or chemicals present in the Eichhornia plant root powder which helps the absorption of color? Why not analyze?
2. "Fish cultured waters were purified enough to use in agriculture processes", - how about Human Consumption?
3. The findings of this doctoral thesis are very important to justify the environmental and health hazard not only to human but also to the ecosystem. I understand simply dumping the effluents are easy and profitable methods discarding the waste to our water ways. With this finding, will you or your PhD adviser or the Periyar University will take any steps to inform  
1) The owners of the textile Industries 2) to the authorities of the local Health board 3) Local Politicians and finally to Central Government elected members about our findings and remedies. I would suggest you to take small steps to inform the effect of untreated textile waste and to suggest your findings to them.



External Examiner:

**Dr. Barur R. Rajeshkumar, MSc., MPhil., PhD**  
Laboratory Manager and Senior Research Scientist  
Cardiovascular Medicine ASC7-1007  
University of Massachusetts Medical School  
368 Plantation Street, Worcester, MA 01605  
Phone: 508 856 6225 (O): 508 340 3127 (cell)

12-1-2014

1<sup>st</sup> December 2014