

Percentage removal of fluoride by experimental plant

Fluoride toxicity induced various visible injury signs like chlorosis, necrosis, tip burn or scorching which initiated on the margins of leaf and finally caused internal cellular injuries [31]. From the entire investigation it was observed that the experimental plant *Spirodela polyrhiza* (**Fig. 3**) showed significant ($p < 0.05$) potentiality with respect to removal of fluoride from water. The removal of fluoride was recorded after 24 h, 72 h, 120 h and 168 h with respect to final concentration. It was observed that percentage removal of fluoride from the solution increased with increasing time period and decreased at elevated concentrations. The fluoride solutions induced different toxic effects on *Spirodela polyrhiza* when exposed for longer periods but at its higher concentrations. The maximum percentage removal of 55.5%, 60.08%, 64.2% and 65.6% fluoride was observed at low concentration of 5 ppm at time interval of 24, 72, 120 and 168 h respectively, while at high concentration of 50 ppm the maximum percentage removal of fluoride analysed was 16.2%, 33.2%, 52.9% and 52.5% (**Table 2**). The removal was found to be almost constant after 120 h and 168 h at same concentration. It means removal efficiency of this macrophyte slowed down during longer exposure period at high concentration. However, the plant is efficient in the removal of fluoride indicating that higher fluoride removal could be possible at longer exposure period.

Effect on plant growth parameters

Growth rate of *Spirodela polyrhiza* in the present investigation is adversely affected under fluoride stress. The percentage decrease in fresh weight was significantly increased and dry to fresh weight ratio was significantly reduced ($p \leq 0.05$) at higher concentrations. The maximum percentage decrease in fresh weight was observed at 50 ppm fluoride solution at the time interval of 168 h (**Table 3**) (**Fig. 4 a**). This may be due to the accumulation of fluoride by *Spirodela polyrhiza* [32]. Moreover, high dry weight to fresh weight ratio (DW/FW) was observed at lower concentration of 5 ppm at the time interval of 120 h and 168 h. Lower dry weight to fresh weight ratio was observed at high concentration of 50 ppm during all the intervals. (**Table 4**) (**Fig. 4 b**).

CONCLUSION:

From the above study it was elucidated that *Spirodela polyrhiza* possess a high level of tolerance to fluoride induced stress based upon its fluoride removal potential. However, further studies are required to understand the specific fluoride tolerance mechanisms and various strategies adopted by *Spirodela polyrhiza* during stressed conditions.

CONFLICT OF INTERESTS:

The authors indicate no conflict of interests.

ACKNOWLEDGEMENT:

The authors are highly thankful to UGC for providing financial aid under UPE fellowship scheme.

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