

Effectiveness of ultra high diluted arsenic is a function of succussion number as evidenced by wheat germination test and droplet evaporation method

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Background: In the preparation of ultra high dilutions (UHD) each dilution step is followed by a succussion. Whereas the physical basis of succussion have been well studied [1], there are only few papers regarding the effects of succussion number (N_s) [2]. In previous studies [3, 4] we showed that arsenic at UHD applied on arsenic stressed wheat seeds stimulates the germination rate.

Aims: Investigate whether N_s applied between the dilution-steps influences the UHD effectiveness.

Methodology:

Plant material and stress treatment: Wheat seeds (*Triticum aestivum* L.) of cv. Pandas were stressed by 30min of poisoning with 5mM As_2O_3 aqueous solution [3, 4].

Classes of treatment: Undiluted and unsuccussed H_2O (C), H_2O and As_2O_3 both at the 45th decimal dilution/succussion (W45x and As45x, respectively). The succussion was handmade and N_s differed for each treatment ($N_s= 4, 8, 16, 32, 40, 70, 100$).

Biological model: In each Petri dish 36 seeds were placed and watered with 20ml of treatment. After 96 hours non-germinated seeds were counted. The experiment was repeated twice and each one consisted in 6 Petri dishes per treatment and 6 trials. The results were analyzed by Poisson test [3].

Droplet evaporation method: The droplet patterns [5] were prepared out of the stressed wheat samples treated either with As45x, W45x ($N_s=8, 32, 70$) or C. The experiment was performed in a 3 day repetition, 3 replicates per day, 5 droplets per replicate. The patterns were evaluated by means of the *ImageJ* software for their local connected fractal dimension (LCFD) values. The data was analyzed by means of the analysis of variance. Multiple mean comparison was carried out by Turkey's HSD test.

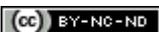
Results: N_s strongly influenced both the biological effectiveness of the treatment (i) and the LCFD of the DEM patterns (ii). In particular: (i) the rate of germinated seeds significantly increased vs. C following treatments with $N_s \geq 32$ for both As45x and W45x; (ii) all As45x ($N_s=8, 32, 70$) and W45x with $N_s=70$ significantly increased the LCFD of DEM patterns vs. C. Both approaches showed that UHD effects increase with the growing N_s , even if there was a non complete correspondence of the significance levels.

Conclusions: Our results show that N_s is an important parameter influencing the UHD effectiveness.

Keywords: Succussion number, ultra high dilutions, arsenic, wheat germination, droplet evaporation method

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