Effect of exogenous treatments with encapsulated salicylic acid on *Arabidopsis thaliana* development

Jimmy Sampedro-Guerrero[1], Vicente Vives-Peris[1], Aurelio Gómez-Cadenas[1], Carolina Clausell-Terol[2]

[1]Departamento de Biología, Bioquímica y Ciencias Naturales, Universitat Jaume I, 12071 Castellón de la Plana, Spain

[2]Departamento de Ingeniería Química, Instituto Universitario de Tecnología Cerámica, Universitat Jaume I, 12071 Castellón de la Plana, Spain

INTRODUCTION

Environmental stresses are the main consequences derived from climate change that affect crop production and plants development. In response to these unfavorable conditions, plants undergo changes at morphological, physiological and biochemical level, improving their tolerance mechanisms to stress. Salicylic acid (SA) participates in plants acclimation and its role on plant responses to biotic and abiotic stresses is well documented. However, the mechanism by which exogenous SA protects plants and its interactions with other phytohormones remains elusive. SA effect, both free and encapsulated (using silica and chitosan capsules), on *Arabidopsis thaliana* development was studied. The effect of SA on roots and rosettes was analysed, determining plant morphological characteristics and hormone endogenous levels.

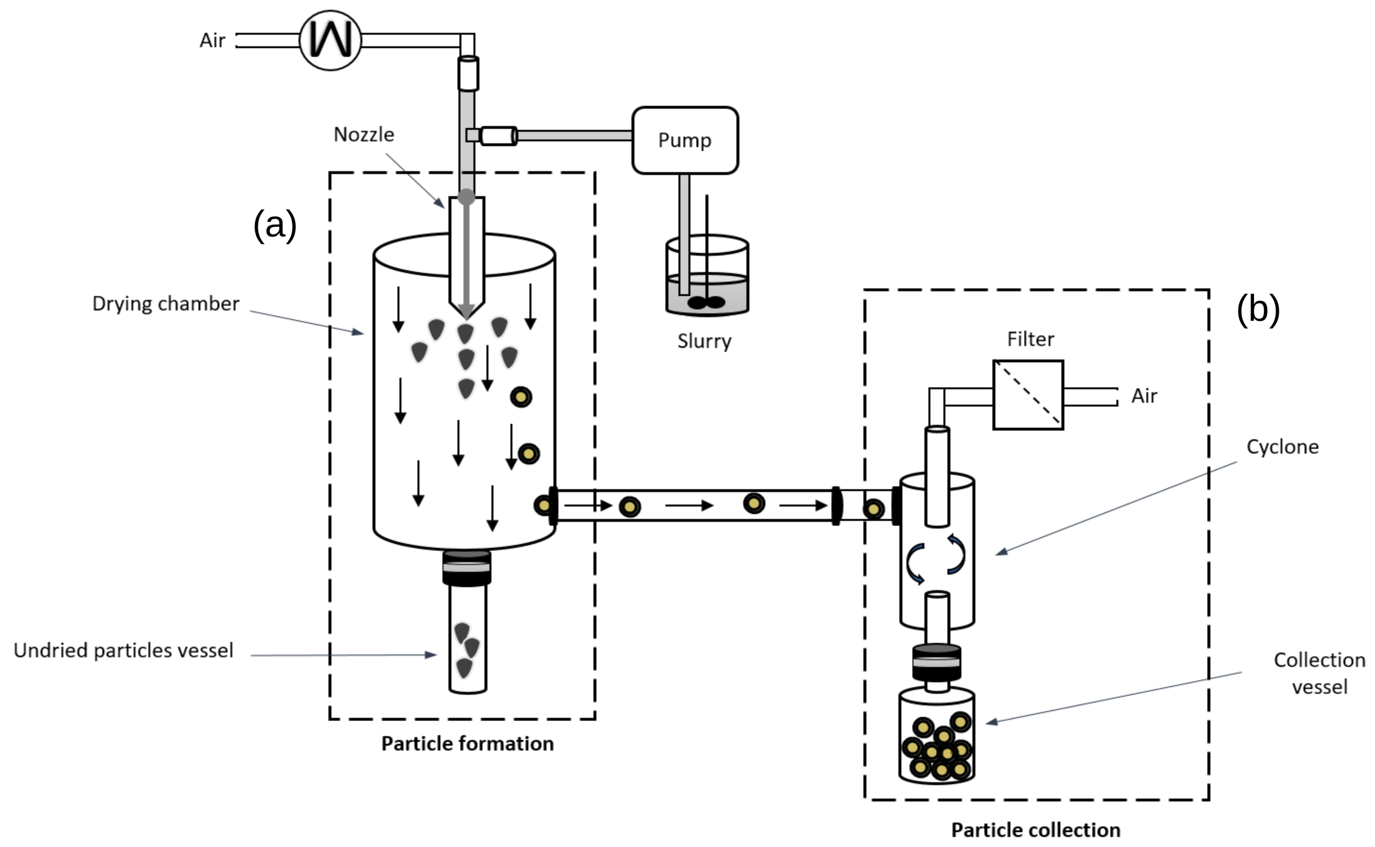

Fig. 1. Schematic diagram of the spray dryer. (a) Encapsulated slurry pumped and particles dried, (b) Recollection of dry particles.

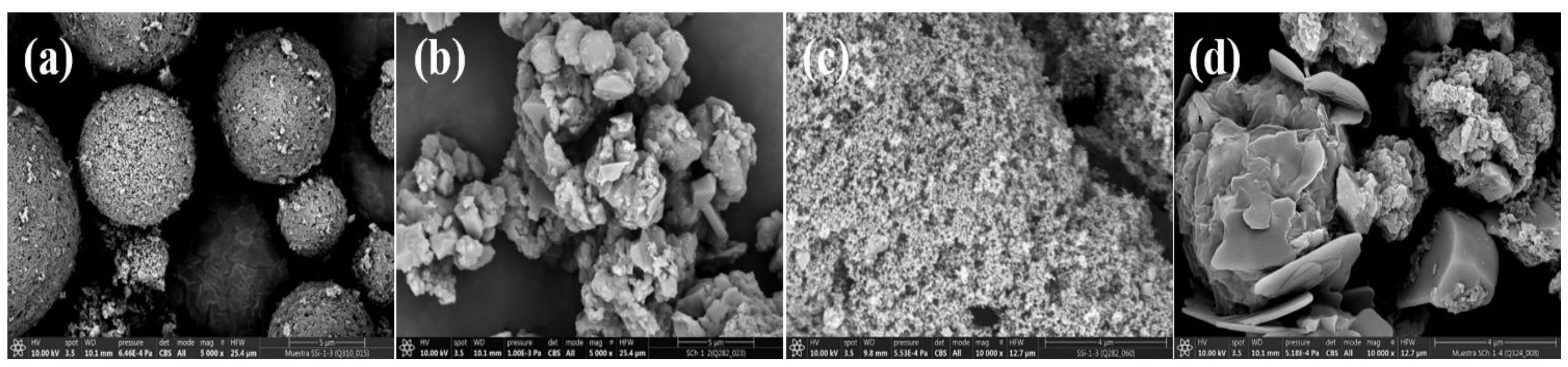

Fig. 2. Scanning electron microscopic (SEM) images of the encapsulated samples prepared with silica and chitosan, Si:SA (1:0.25) (a-c) and Ch:SA (1:0.5) (b-d) , respectively. (a-b) 5000x magnification and (c-d) 10000x magnification.

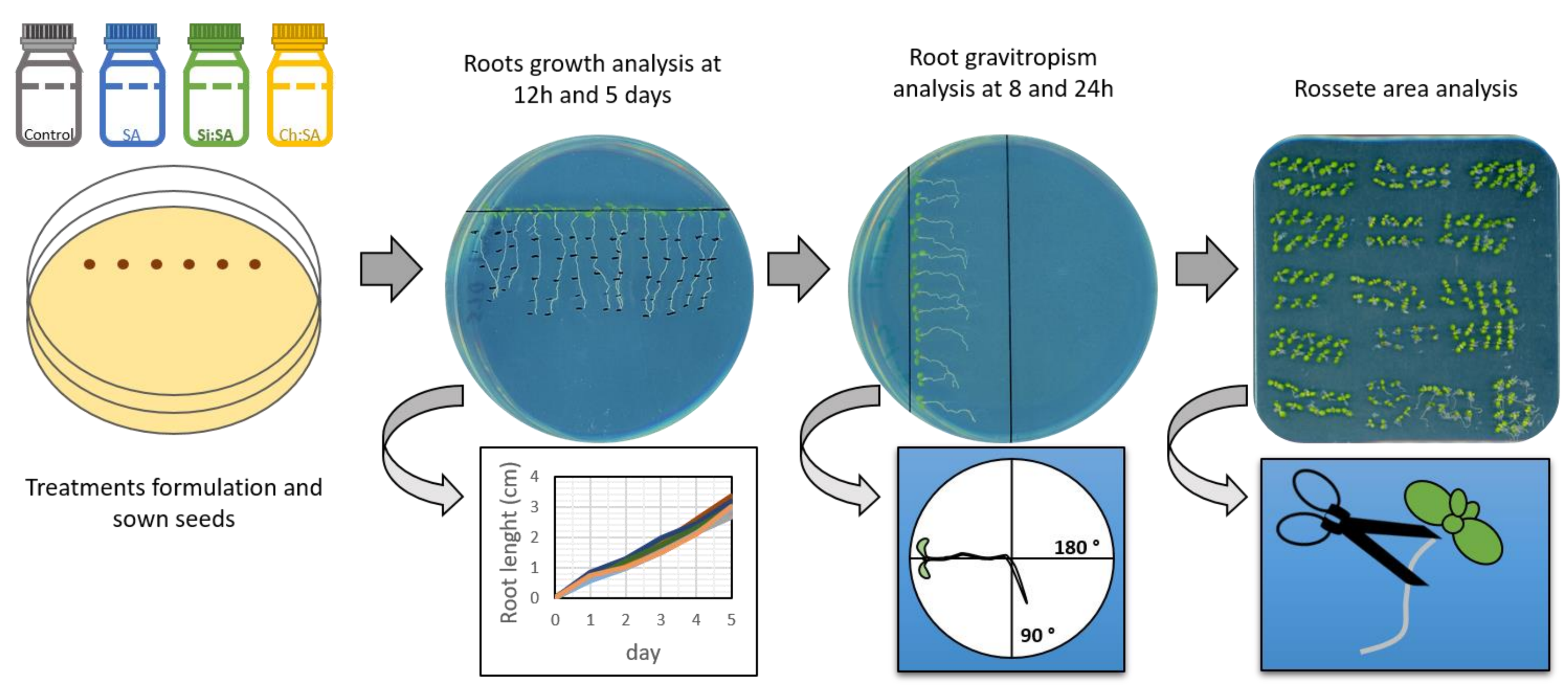

Fig. 3. Experimental method developed to determine the effect of free and encapsulated SA (Si:SA and Ch:SA) in Arabidopsis thaliana plants.

RESULTS AND DISCUSSION

Free SA treatment affected length, growth rate, gravitropic response of roots and rosette size in a dose-dependent manner. This damage was due to the increase of root endogenous SA concentration that led to a reduction in auxin levels. The encapsulation process reduced the deleterious effects of free SA on root and rosette growth and in the gravitropic response. Encapsulation allowed for a controlled release of the SA, reducing the amount of hormone available and the uptake by the plant, mitigating the deleterious effects of the free SA treatment.

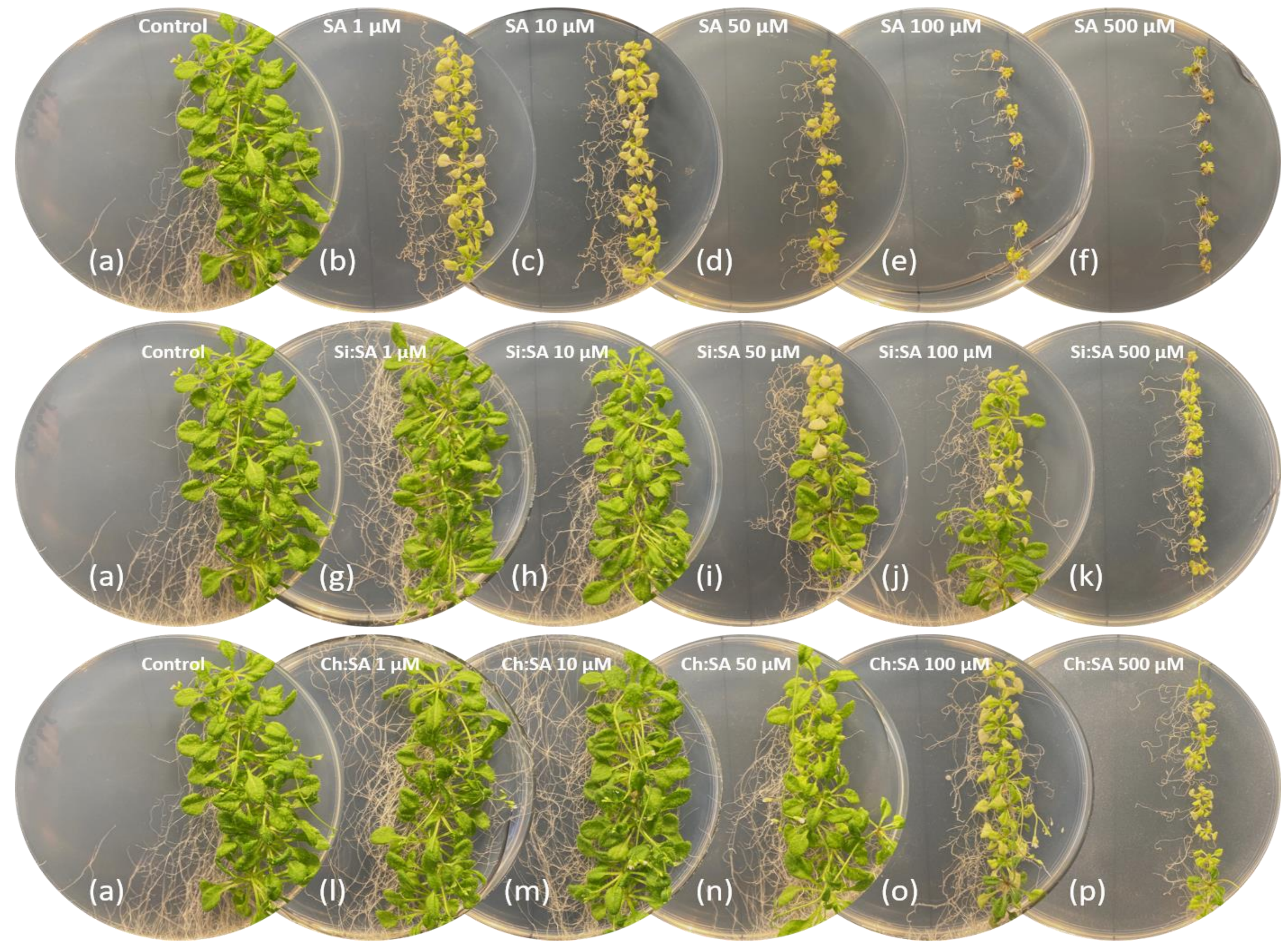

Fig. 4. Effect of free SA, Si:SA and Ch:SA on plant performance in Col-0 Arabidopsis plants. 5-day-old plants were transferred to media containing the different SA treatments and pictures were taken 28 days later.

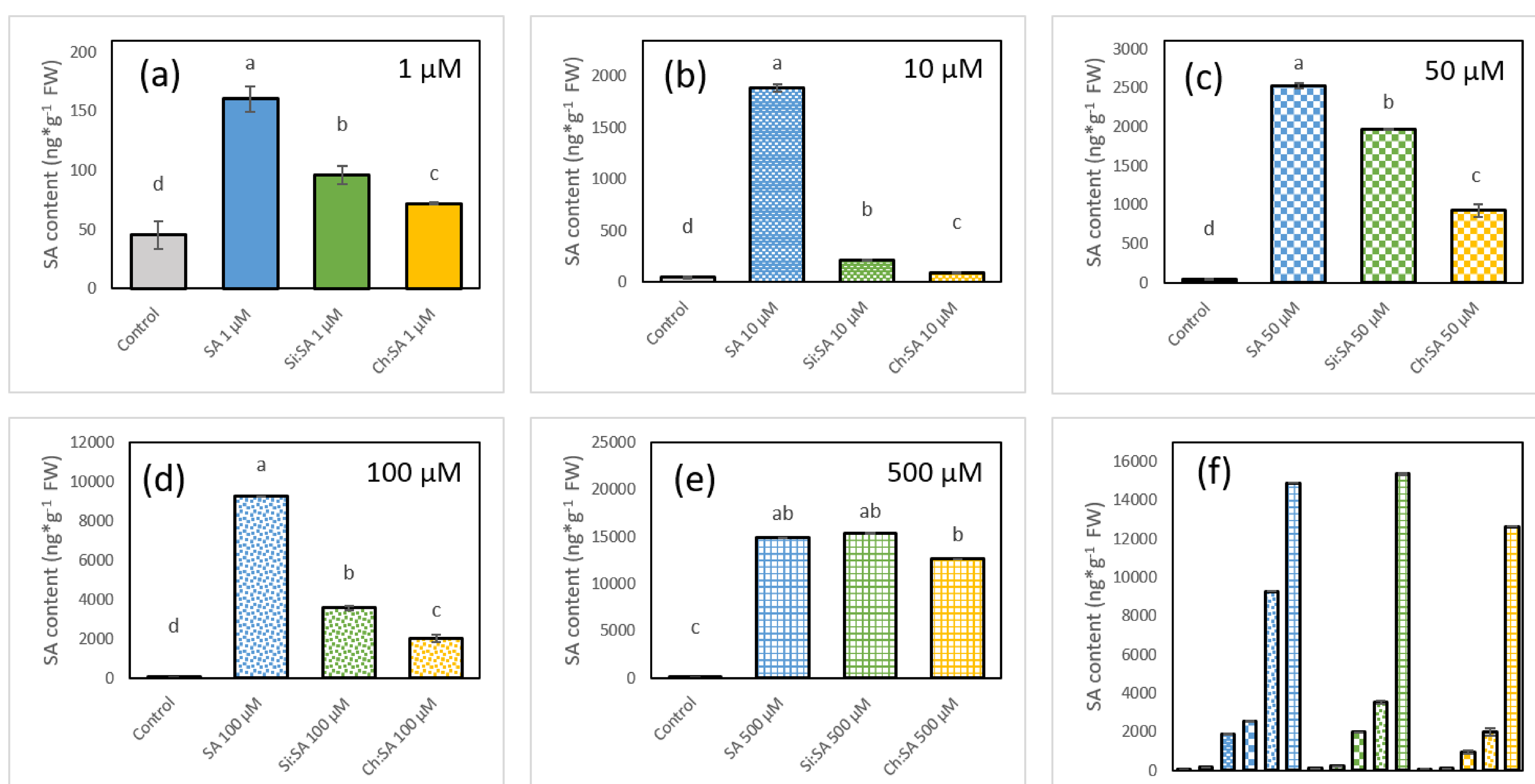

Fig. 5. Effect of free SA, Si:SA and Ch:SA on endogenous SA levels in roots of Col-0 Arabidopsis plants. 5-day-old plants were transferred to media containing the different SA treatments and plant hormones measured 28 days later. Graph (f) depicts SA levels in the three treatments at all doses, and graphs (a), (b), (c), (d) and (e) compare SA levels among the treatments at each dose. Different letters indicate significant differences among treatment groups at p≤0.05.

CONCLUSIONS

1. SA encapsulation, either with silica or chitosan, results in a controlled release of SA and reduces the negative effects suffer by plants during treatments.
2. Encapsulation appears as an attractive technology to deliver phytohormones when crops are cultivated under adverse conditions, and it can be a good tool to perform basic experiments in phytohormone interactions.

ACKNOWLEDGMENTS

MCIN/AEI/10.13039/501100011033 and by the European Union Next Generation (TED2021-129795B-I00) and AGROALNEXT program, funded by MCIN, European Union Next Generation EU-PRTR-C17.I1- and Generalitat Valenciana (AGROALNEXT/2022/010). Funding was also obtained from Generalitat Valenciana through the programs CIAICO/2021/063 and GRISOLIAP/2020/043.

MORE INFORMATION

jsampedr@uji.es