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# Effects of lanthanum on the growth and essential oil components of lavender under osmotic stress

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**Abstract:** The effects of lanthanum on growth, soluble sugar content, essential oil contents and quality were studied in lavender plant (*Lavandula Angustifolia* Mill, Variety 701) under osmotic stress by means of PEG-6000 solution. The results show that osmotic stress could reduce the growth rate of lavender, and increase the content of SSC (soluble sugar concentration) to some extent. Compared with control group, the contents of essential oil in flowers and leaves respectively increase by 45.6% and 48.3% in the osmotic stress group induced by 15% PEG-6000. However, the presence of lanthanum can make the contents of essential oil in the flowers and leaves of stressed lavender plants enhance by 19.4% and 18.6%, respectively. Under osmotic stress, the relative contents of four kinds of lavender essential oil compositions of camphor, linalool, linalyl acetate and lavandulol acetate in the lavender flowers were successively 22.63%, 0.61%, 25.46%, 7.03%, and 20.17%, 0.62%, 20.72%, 10.80% respectively in the presence and absence of lanthanum. The contents of all four main components of lavender essential oils meet the requirements of the national standard under osmotic stress in the presence of lanthanum. However, in the absence of lanthanum, the contents of linalyl acetate and lavandulol acetate does not meet the requirements of the national standard under osmotic stress. Moreover, the contents of five components of borneol, camphor, eudesmol, caryophyllene oxide and bicyclic sesquiphellandrene from the essential oil of lavender leaves are 12.89%, 3.84%, 8.76%, 11.30% and 8.10% respectively. The total content of above five components accounts for 44.89% of the essential oil of the lavender leaves. Particularly, the borneol content in leaf essential oil is up to 12.89%. It is 125.2 times the amount of borneol in the flower essential oil. In conclusion, the suitable concentration of lanthanum can improve the adaptability of lavender plants, and heighten the content and quality of lavender essential oil to some extent under osmotic stress.

**Keywords:** Lanthanum; Lavender; Essential oil; Secondary metabolites; Osmotic stress; Rare earths

## 1. Introduction

Lavender (*Lavandula Angustifolia* M.), which is native to the Mediterranean coast, has good resistance to drought<sup>[1]</sup>. And it is a kind of multipurpose plant with ornamental, edible and medicinal functions<sup>[2-5]</sup>. Lavender is called the vanilla queen owing to its high quality essential oil

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