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# *Interactive comment on* "Seagrass as major source of transparent exopolymer particles in the oligotrophic Mediterranean coast" *by* Francesca Iuculano et al.

**Anonymous Referee #1**

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General comments.

This paper focuses on the production of TEP by the litter of Posidonia oceanica, and discusses the implications of such TEP production in the context of the oligotrophic Mediterranean Sea. This work combines a field study conducted for 2-3 years in two coastal sites with a laboratory experiment. The first field study site (Faro Cap Ses Salines) is a pristine and oligotrophic rocky shore system, and the second one (Es Caragol beach) is a sandy beach covered with abundant seagrass detritus. TEP dynamics were monitored at these two sites and were compared in order to determine the impact of seagrass detritus on TEP concentration. This field study was completed by a laboratory study during which P. oceanica leaf litter collected from the seashore of



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Es Caragol beach was incubated at 26.3°C in seawater collected at the same site, and TEP production was monitored during 264 hours.

This work is interesting because it is the first to report the impact of P. oceanica leaf litter on TEP dynamics in a coastal site. This work clearly shows that the presence of leaf litter is at the origin of a significant TEP production. This conclusion is drawn from the fact that TEP concentrations were on average 10-fold higher in the coastal beach accumulating leaf litter, in comparison to TEP concentrations in the rocky shore system. The high production of TEP from decomposing leaf litter in the laboratory confirms the field observation.

While this work shows convincingly that P. oceanica detritus can be at the origin of a high TEP production in coastal areas of the oligotrophic Mediterranean Sea, the discussion concerning the impact of such TEP production is less convincing.

Specific comments.

The main issue concerns the conclusions drawn from the results obtained, i.e. seagrass is a major source of TEP that can explain the elevated TEP concentration relative to the low chlorophyll a concentration in the Mediterranean Sea. This statement comes from the estimate of TEP production from seagrass obtained, 0.10 Tg C per year, which in my opinion is an absolute maximum for the following reasons:

- This estimate of the release rate of TEP from decomposing seagrass was obtained using the highest values of the surface area covered by P. oceanica in the Mediterranean Sea (50,000 km2), while estimates are from 25,000 to 50,000 km2 (e.g. Borum et al. 2004, Boudouresque et al. 2006).

- This estimate is based on the assumption that the TEP yield from leaf litter in the Mediterranean Sea is constant during the year and equals that measured in the laboratory under controlled conditions, i.e. 2344 $\mu$g TEP-C DW-1. But this estimate was obtained by incubating leaf litter at 26.3°C, while this temperature is not met all over





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the year in the Mediterranean Sea (reported range in the present work from 12.4 to 27.8°C), and that this decomposition process is temperature dependant (e.g. Østergaard Pedersen et al. 2011). The latter study shows that the maximum decomposition rate occurs around 25°C. In addition, the reported temperature range from 12.4 to 27.8°C is for surface waters, while a large fraction of the P oceanica leaf is exported in deep waters (i.e. at temperature lower than in surface waters). Therefore, the estimate given assumes that all the leaf litter is decomposed at 26.3°C, although even when the surface temperature is 26.3°C, a significant fraction of leaf decomposes in lower temperature, at depth.

- This estimate is based on an average production of P. oceanica of 2.40 g DW m-2 d-1 (i.e. 876 g DW m-2 y-1). While this estimate of P. oceanica production seems correct for the whole plant, the leaf production is much lower, and varies between 50 and 150 g DW m-2 y-1 (Pergent et al. 1994, 1997). In my opinion, the leaf production should be used since it is at the origin of leaf litter.

The estimate of the TEP production from seagrass (leaf litter) should acknowledge the above limitations, and a range of production should be given. Providing only a maximum theoretical value as a reference value can lead to a severe overestimation of the role of seagrass in TEP production in the Mediterranean Sea.

In addition, it should be noted that the elevated TEP concentration relative to the low chlorophyll a concentration in the Mediterranean Sea does not need TEP production from seagrass to be explained. It has been showed that the relationship between TEP and chlorophyll a concentrations was only linear during the growth phase of phytoplankton blooms, and that TEP could accumulate in the water column of a oceanic site (no impact of leaf litter expected) in the Mediterranean Sea at low chlorophyll a concentration, due to carbon overflow during nutrient limiting conditions (e.g. Mari et al. 2001, Radić et al. 2005). This leads to a summer accumulation of TEP in surface layer of the stratified Mediterranean Sea at low chlorophyll concentration, explaining the high TEP/chloro during this period (as shown in Figure 3). Therefore, I think the

last sentence on page 5 (lines 133-135) "These observations suggest that P. oceanica meadows, the dominant ecosystem in Mediterranean coastal waters, are the source of TEP precursors responsible for the elevated TEP/Chl a ratios characteristic of the Mediterranean Sea" is not correct.

Lines 123-125: This sentence suggests that TEP precursors are released directly by P. oceanica leaf litter. How about the microbial activity associated with litter? The role of microbial communities associated with leaf litter should be acknowledged.

Technical corrections.

Line 35: The work by Thingstad and Rassoulzadegan (1999) does not discuss the littoral zone of the Mediterranean Sea.

Lines 33-40: This paragraph is not logical as it is based on a pivotal argument that is not valid. It says (1) P. oceanica produces high amounts of detritus, (2) in an oligotrophic environment, (3) oligotrophic, but with TEP concentration exceeding what can be expected from TEP/chl a or TEP/bact abundance ratios, (4) this discrepancy can only be explained by a high TEP production by P. oceanica. But as explained above, there is no linear relationship between TEP and chlorophyll concentrations.

Line 41: Study instead of studying.

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