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### Synthesis and Antimicrobial Activity of Poly (Oxyethylene)S Functionalized with Quaternary Phosphonium End Groups

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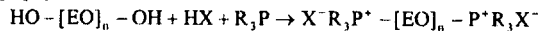
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## Synthesis and Antimicrobial Activity of Poly(Oxyethylene)s Functionalized with Quaternary Phosphonium End Groups

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Poly(oxyethylene)s functionalized with quaternary phosphonium end groups were obtained by converting terminal hydroxyl end groups into phosphonium ion groups in the polymer-analogous reactions with phosphines and hydrogen chloride. The products were characterized by: IR, UV, <sup>1</sup>H NMR spectroscopy, thin-layer chromatography.



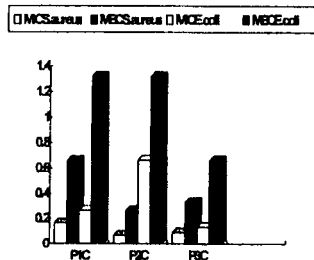
where:  $[\text{EO}]_n = -\text{CH}_2\text{CH}_2-[\text{OCH}_2\text{CH}_2]_{n-1}$ ,  $n=22$ ;  $\text{X}^- = \text{Cl}^-$ ;  $\text{R} = -\text{C}_6\text{H}_5$ ;  $-\text{C}_2\text{H}_5$ ;  $-\text{C}_4\text{H}_9$ .

The functionalization degrees with quaternary phosphonium groups are relatively high (Table I) and well suited for the use of the products as policationic biocides.

Table I. Characteristics of the poly(oxyethylene)s functionalized with phosphonium end groups.

Code	R	P, (%)	$y^a$	$\eta^b$	$M_n^c$	$G_M^d$ (mmoles $\text{R}_3\text{P}^+\text{X}^-/\text{g polymer}$ )
P <sub>1</sub> C	-C <sub>6</sub> H <sub>5</sub>	2.75	0.590	59.0	1330.99	0.44
P <sub>2</sub> C	-C <sub>2</sub> H <sub>5</sub>	4.85	0.993	99.3	1273	0.78
P <sub>3</sub> C	-C <sub>4</sub> H <sub>9</sub>	2.11	0.400	40.0	1176.40	0.34

<sup>a</sup>  $y$  - fraction of poly(oxyethylene) bearing the final groups ( $G_f$ ); <sup>b</sup>  $\eta_f = y/x \cdot 100$  (% molar),  $x$  - fraction of the poly(oxyethylene)s bearing the  $G_i$  groups; <sup>c</sup>  $M_{nf} = M_n + m y (M_{Gf} - M_{Gi})$ ; <sup>d</sup>  $G_M = y/M_{nf}$ .



The antimicrobial activity of the poly(oxyethylene)s functionalized with quaternary phosphonium end groups was manifest at contact with both bacterial culture of *Staphylococcus aureus* and *Escherichia coli*. The figure shows both the values of minimum inhibitory concentration (MIC) evaluated by the spread plate method and minimum bactericidal concentration (MBC) evaluated by the viable cell counting method.