SURFACE ACTIVITY OF HERBICIDAL IONIC LIQUIDS BASED ON DICAMBA ESTERQUATS WITH 4-CPA, 2,4-D, MCPA, MCPP AND CLOPYRALID ANIONS

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INTRODUCTION

Among the known ionic liquids, a relatively particularly interesting group are ionic liquids with surface activity. Broad interest in these compounds results from their unique structure, which allows them for facile adsorption on water-air interface. The ion responsible for surface properties consists of both hydrophilic and hydrophobic fragments. Although the numerous surface active ionic liquids are known, a newer compounds characterized by more beneficial properties, which may be used in the various branches of industry, are constantly being searched for. Surface active ionic liquids may be used in medicine as a part of a system of supplying pharmaceuticals or in agriculture to neutralize weeds.

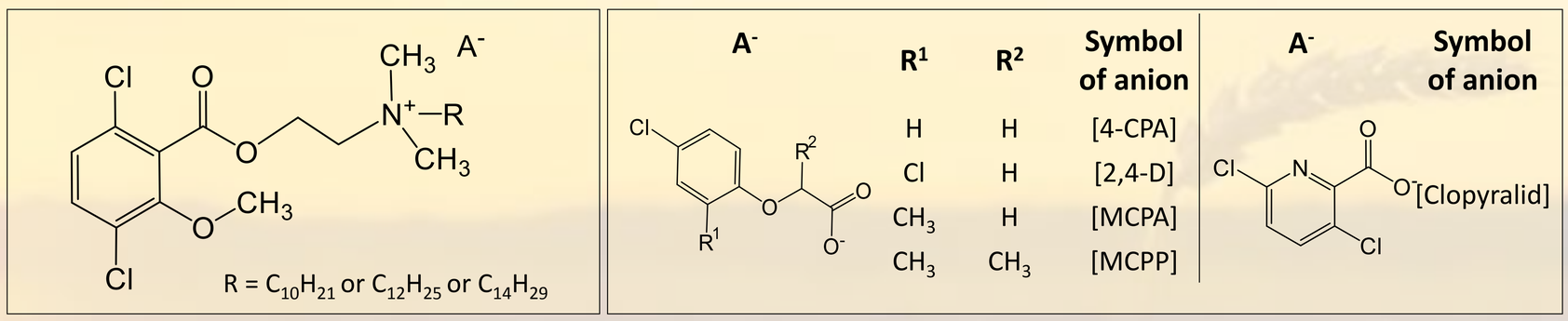
OBJECTIVE OF WORK

The aim of this study was to investigate the surface activity in the aquatic environment of a new type of compound – dicamba esterquats with herbicidal anions.

RESULTS

The surface tension was determined using the shape drop method. This method was calculated by analyzing the profile of the drop according to the Laplace equation. The measurements were carried out by use a DSA 100 analyzer (Krùss, Germany, the accuracy of 0.01 mN ·m $^{-1}$) at 25˚C.

The contact angle (CA) was carried out by the use of sessile drop method (which consists in) using Young-Laplace equation. In addition, the method of the drop of liquid was deposited on a solid paraffin surface. The drop which was used measuring was produced before. The CA was determined on the basis of the tangent slope at the 3-phase point (solid paraffin surface-liquid, liquid-air and air-solid paraffin surface).
The surface activity properties are presented in Figures 1- 3 and in the Table 1.



A^-	R^1	R^2	Symbol of anion
	H	H	[4-CPA]
	Cl	H	[2,4-D]
	CH_3	H	[MCPA]
	CH_3	CH_3	[MCPP]

A^-	Symbol of anion
	[Clopyralid]

Figure 1. Esterquats with herbicidal anions.

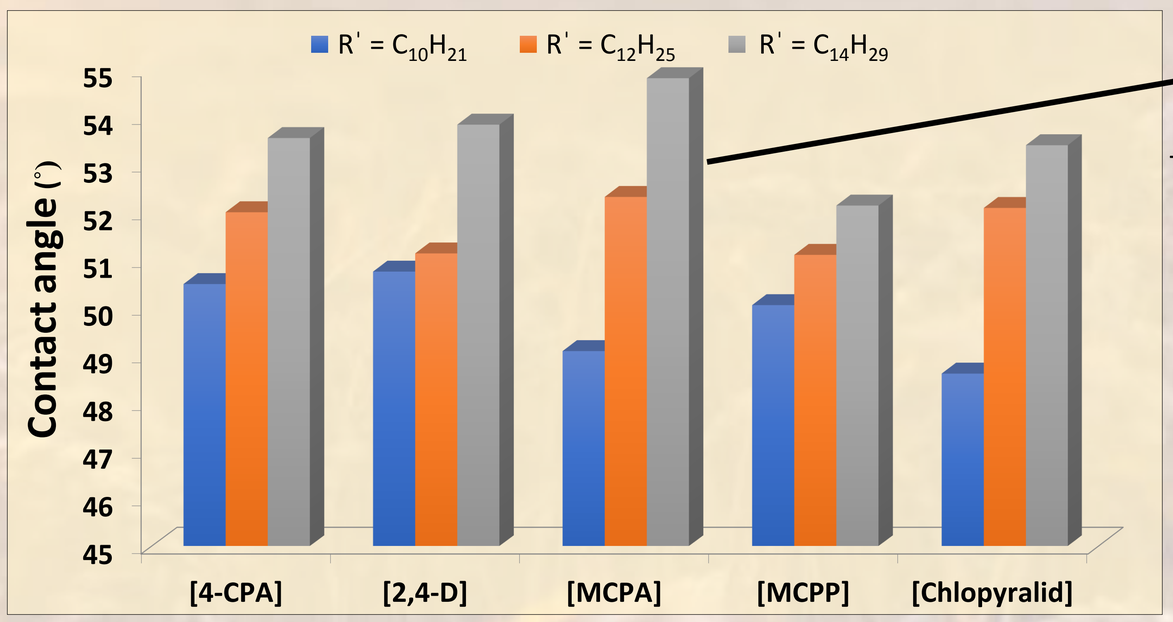


Figure 2. The contact angle of ionic liquids solutions.

The photo of drop of ionic liquid solution (*drop was registered by (CCD) camera).*

Table 1. Surface activity of the analyzed HILs.

Compound	CMC [mM]	γ_{CMC} [mN ·m $^{-1}$]
[Dicamba-C_{10}][4-CPA]	1.42	24.9
[Dicamba-C_{12}][4-CPA]	4.64	25.9
[Dicamba-C_{14}][4-CPA]	2.12	30.7
[Dicamba-C_{10}][2,4-D]	2.86	27.3
[Dicamba-C_{12}][2,4-D]	6.83	28.2
[Dicamba-C_{14}][2,4-D]	7.10	32.4
[Dicamba-C_{10}][MCPA]	1.19	23.8
[Dicamba-C_{12}][MCPA]	1.53	29.2
[Dicamba-C_{14}][MCPA]	2.24	32.6
[Dicamba-C_{10}][MCPP]	0.29	33.8
[Dicamba-C_{12}][MCPP]	0.71	30.4
[Dicamba-C_{14}][MCPP]	0.68	36.4
[Dicamba-C_{10}][Clopyralid]	0.52	32.3
[Dicamba-C_{12}][Clopyralid]	0.14	32.3
[Dicamba-C_{14}][Clopyralid]	0.06	34.9

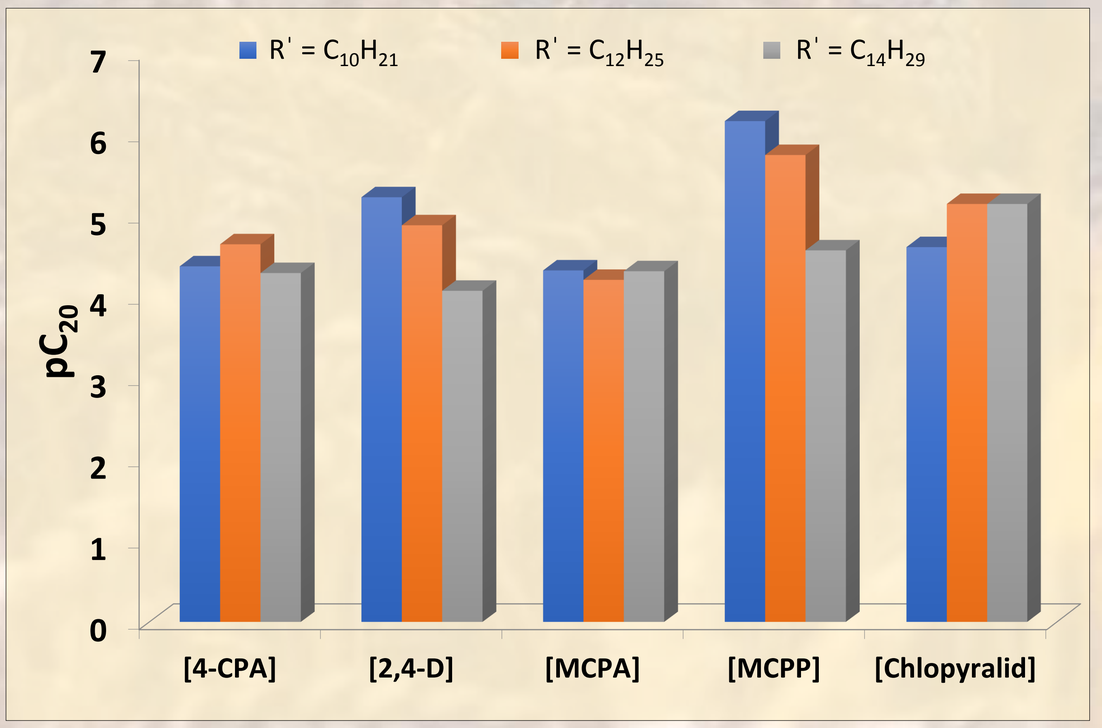
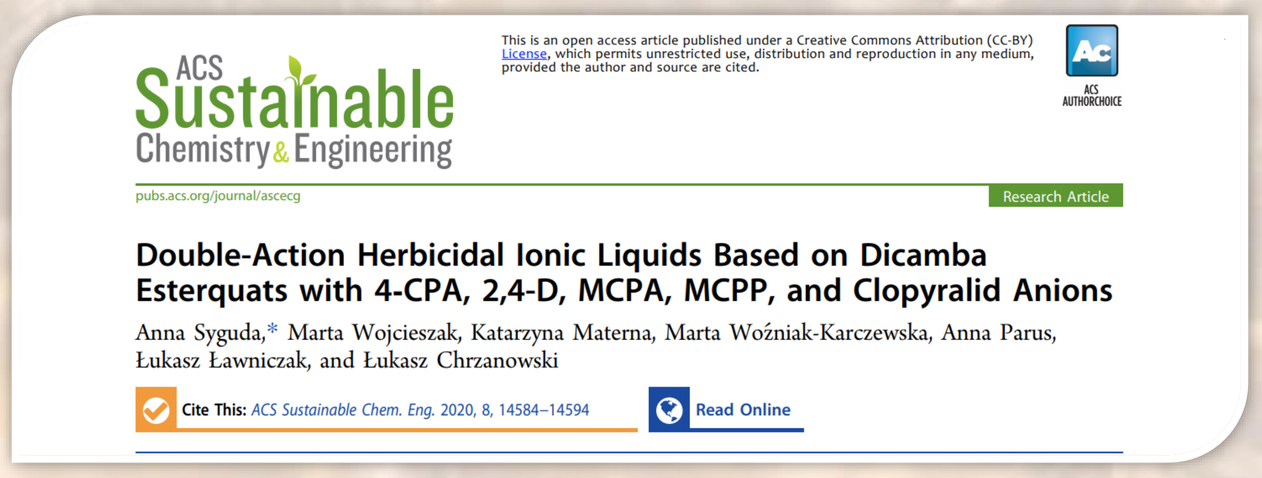


Figure 3. Dependency of pC_{20} on the number of carbon atoms in alkyl chain of ionic liquid.



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Research Article

Double-Action Herbicidal Ionic Liquids Based on Dicamba Esterquats with 4-CPA, 2,4-D, MCPA, MCPP, and Clopyralid Anions

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CONCLUSION

1) The determined values allow to classify the studied HILs as partially wetting liquids.
2) The length of the alkyl substituents in the cation has a significant influence on the surface activity in water.
3) Surface tension values for water solutions of different HILs were obtained at different concentrations.
4) Higher value of the pC_{20} parameter is associated with the higher efficacy of the corresponding compound, i.e. the compound more readily adsorbs at the interface and reduces the surface tension by 20 mN m^{-1}.

NATIONAL SCIENCE CENTRE POLAND

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