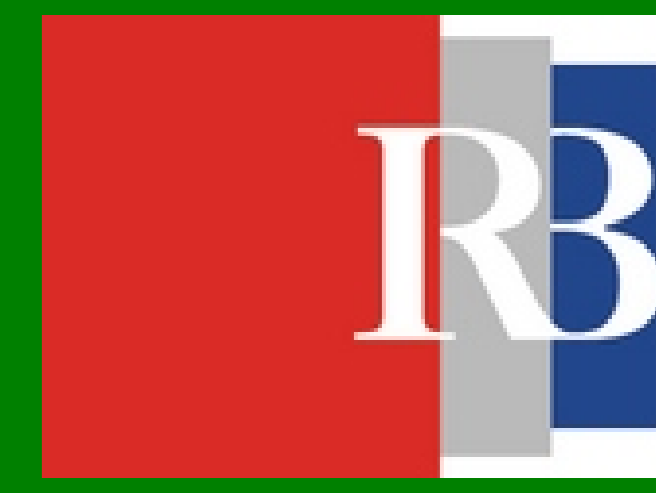


OKOLIŠ

# Seawater's organic polymers – how to behave on mercury drop?

S. Strmečki Kos

Laboratory for physical chemistry of aquatic systems, Division for marine and environmental research



Carbohydrates, proteins and lipids are the main groups of organic compounds found in seawater. They represent 20% of organic matter present in natural waters and are compounds of small molecular mass characterized on molecular level in plankton and sediments. Phytoplankton is the highest producer of organic matter in seawater's photic zone. Polymeric organic material, mainly composed from polysaccharides (PS), represents the main fraction (up to 80%) of phytoplankton exudates.

Catalyzation proceses of:

- protein human serum albumin (HSA),
- polysaccharide ι-carrageenan and
- polymers in seawater samples

were analyzed by constant current chronopotentiometric stripping analysis (CPSA) method.

Why peak "H" ?

Catalytic hydrogen evolution

High sensitivity

Heyrovsky

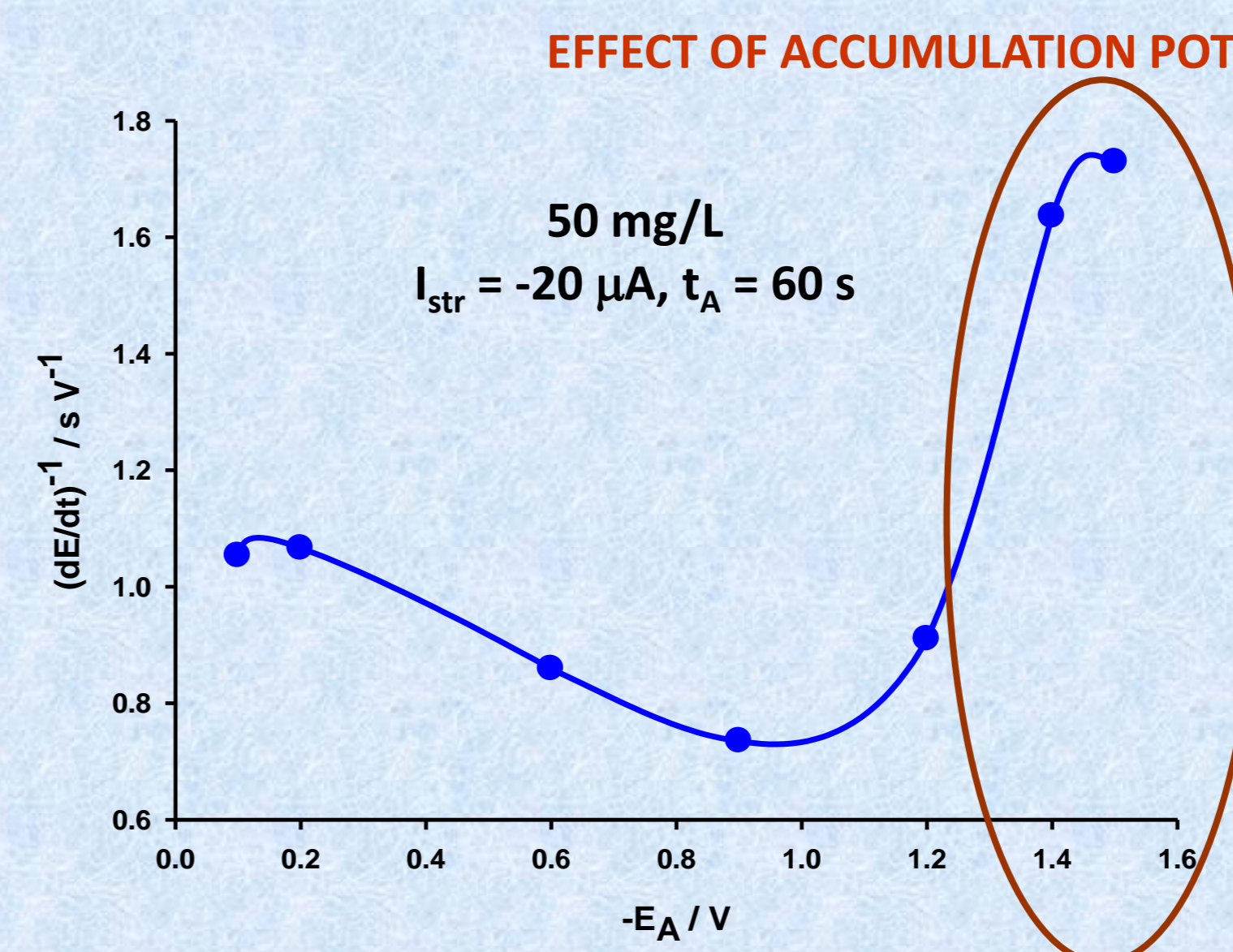
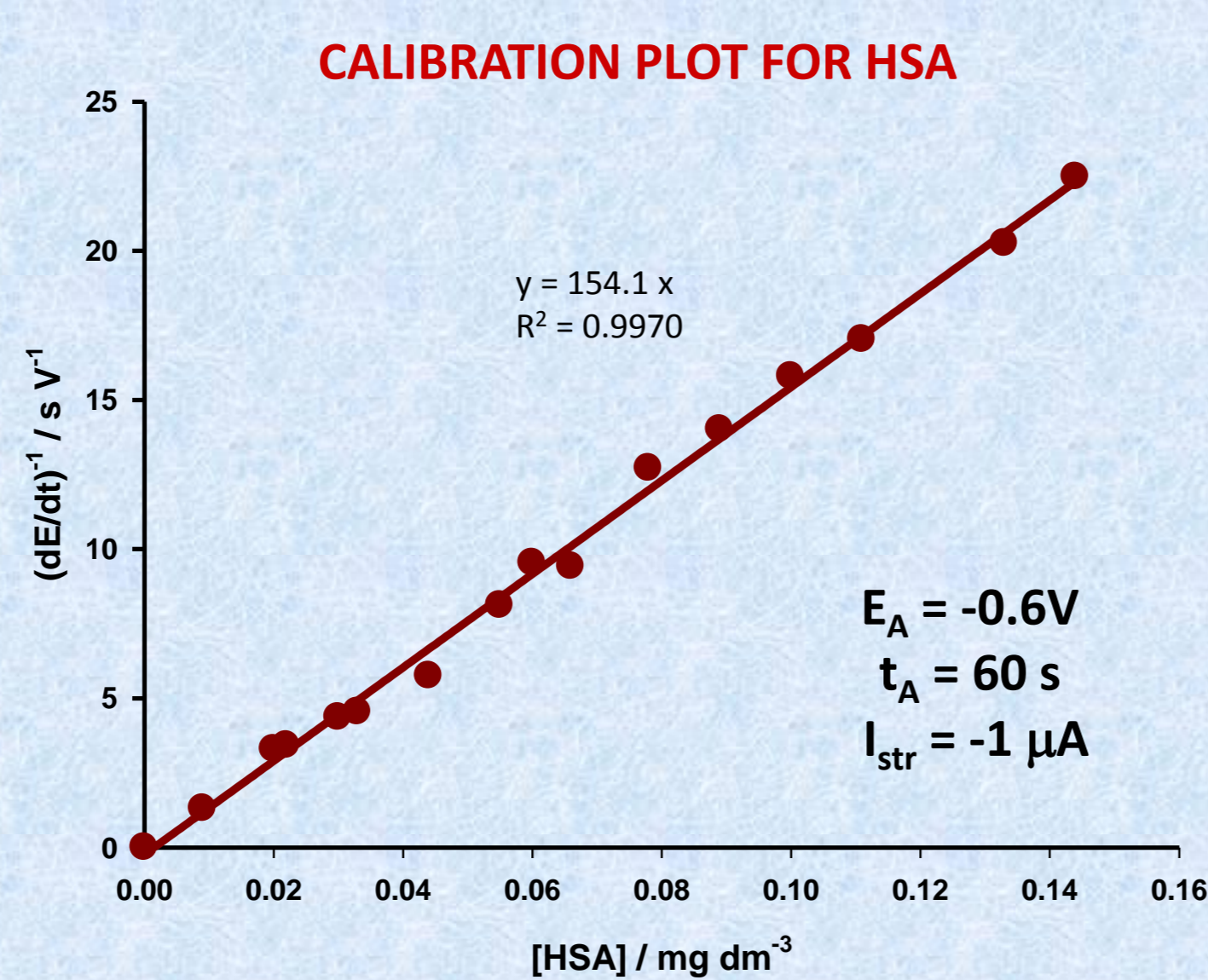
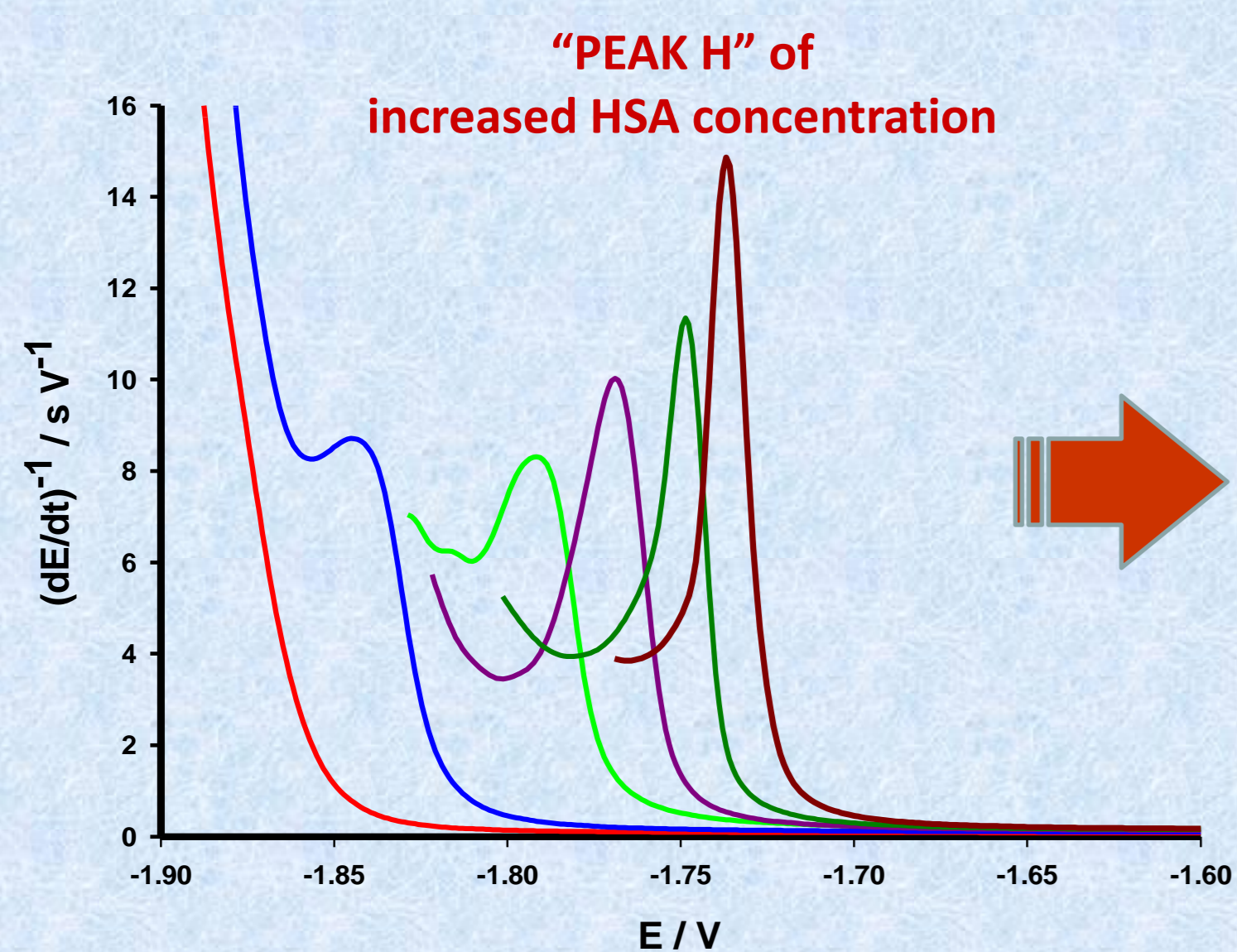
## ORGANIC CATALYST OF HYDROGEN EVOLUTION ON MERCURY DROP

### N-POLYMERIC ORGANIC MATERIAL (N-POM)

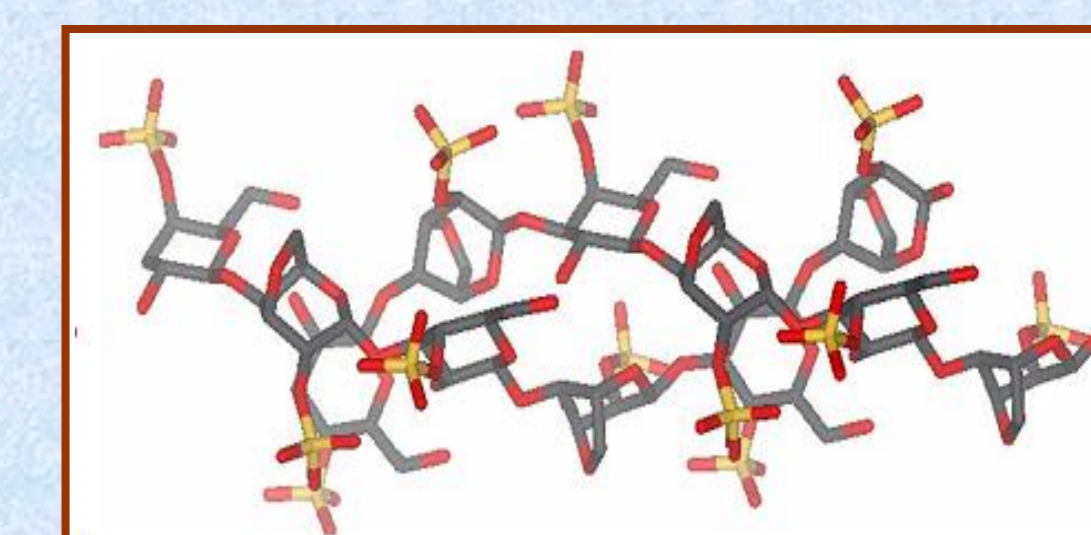
electrolyte: "organic matter free" seawater

### SULPHATED POLYSACCHARIDES

electrolyte: 0.55 M NaCl + 0.5 M acetate buffer



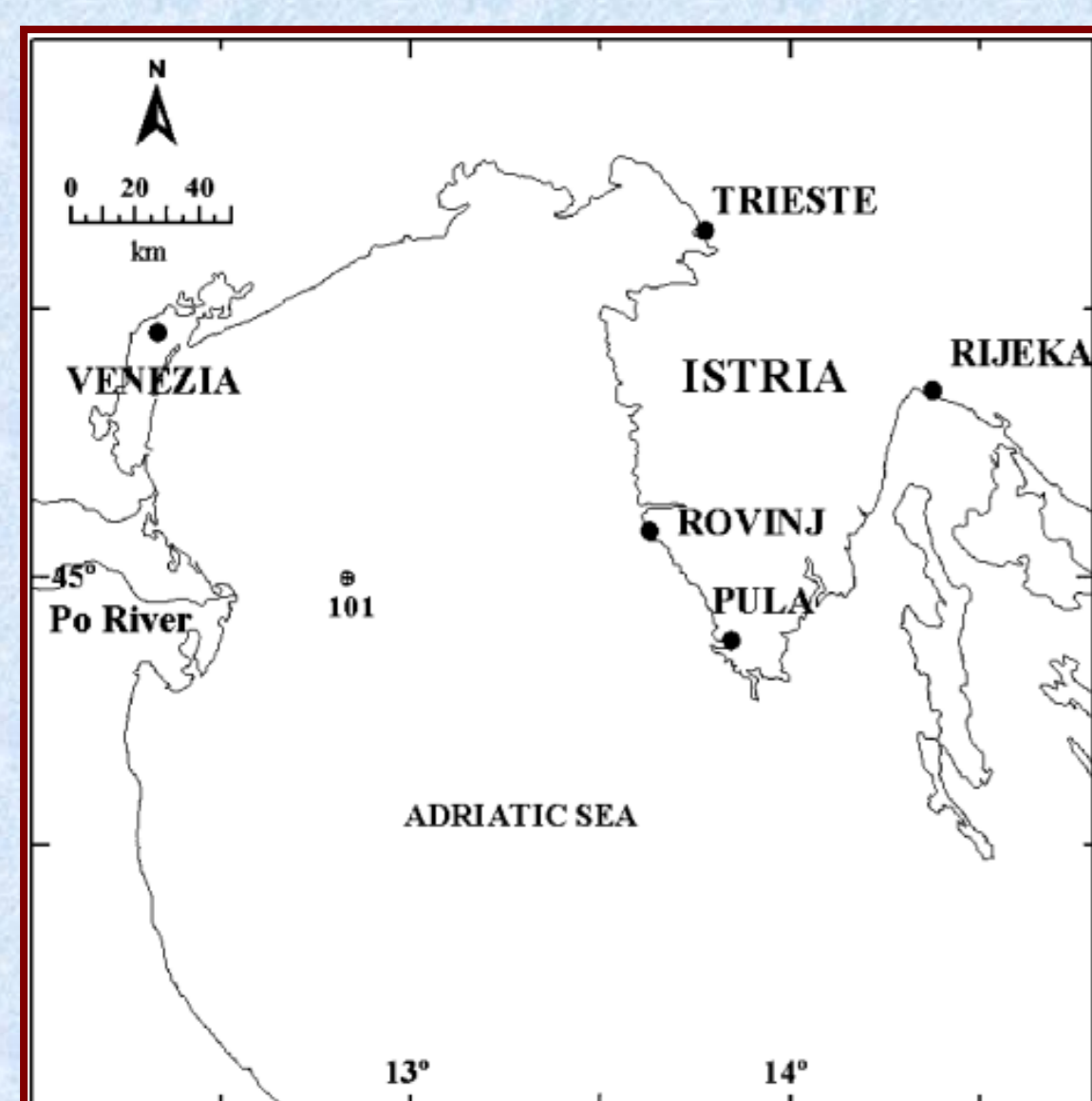
ι-CARRAGEENAN 3D STRUCTURE  
threefold, righthanded, half-staggered, parallel double helix stabilized by interchain hydrogen bonds



$E_A < -1.4$  V  
uncoiling of double helix – releasing of catalytically active groups previously hidden in the structure

Concentrations of N-POM, surface active substances (SAS) and dissolved organic carbon (DOC) measured in seawater samples from Northern Adriatic station 101.

date of sampling	depth / m	N-POM		SAS		N - POM / SAS	DOC / mg C dm⁻³	N - POM / DOC
		$-E_p$ / V	$(dE/dt)^{-1} / s V^{-1}$	eq. μg HSA dm⁻³	eq. mg T-X-100 dm⁻³			
6 June 2008	0.5	1.746	9.3	60	0.192	0.31	1.57	0.038
~31	-	-	0	0	0.088	0	1.04	0
26 June 2008	0.5	1.736	11	71	0.363	0.19	1.85	0.038
~31	-	-	0	0	0.136	0	1.35	0
20 October 2008	0.5	1.791	2.8	18	0.251	0.072	1.01	0.018
~31	-	1.780	0.30	0.2	0.214	0.0009	0.80	0.0002
17 January 2009	0.5	-	0	0	0.102	0	1.01	0
~31	-	-	0	0	0.055	0	1.09	0
17 March 2009	0.5	1.772	4.7	30	0.165	0.182	1.25	0.024
~31	-	1.805	1.5	9.6	0.073	0.13	0.94	0.010



Sampling station 101 in Northern Adriatic Sea

### N-POM IN SEAWATER SAMPLES

part of SAS and DOC

variable through the seasons:

higher for season of increased biological production (June 2008)

lower for winter samples (January 2009)

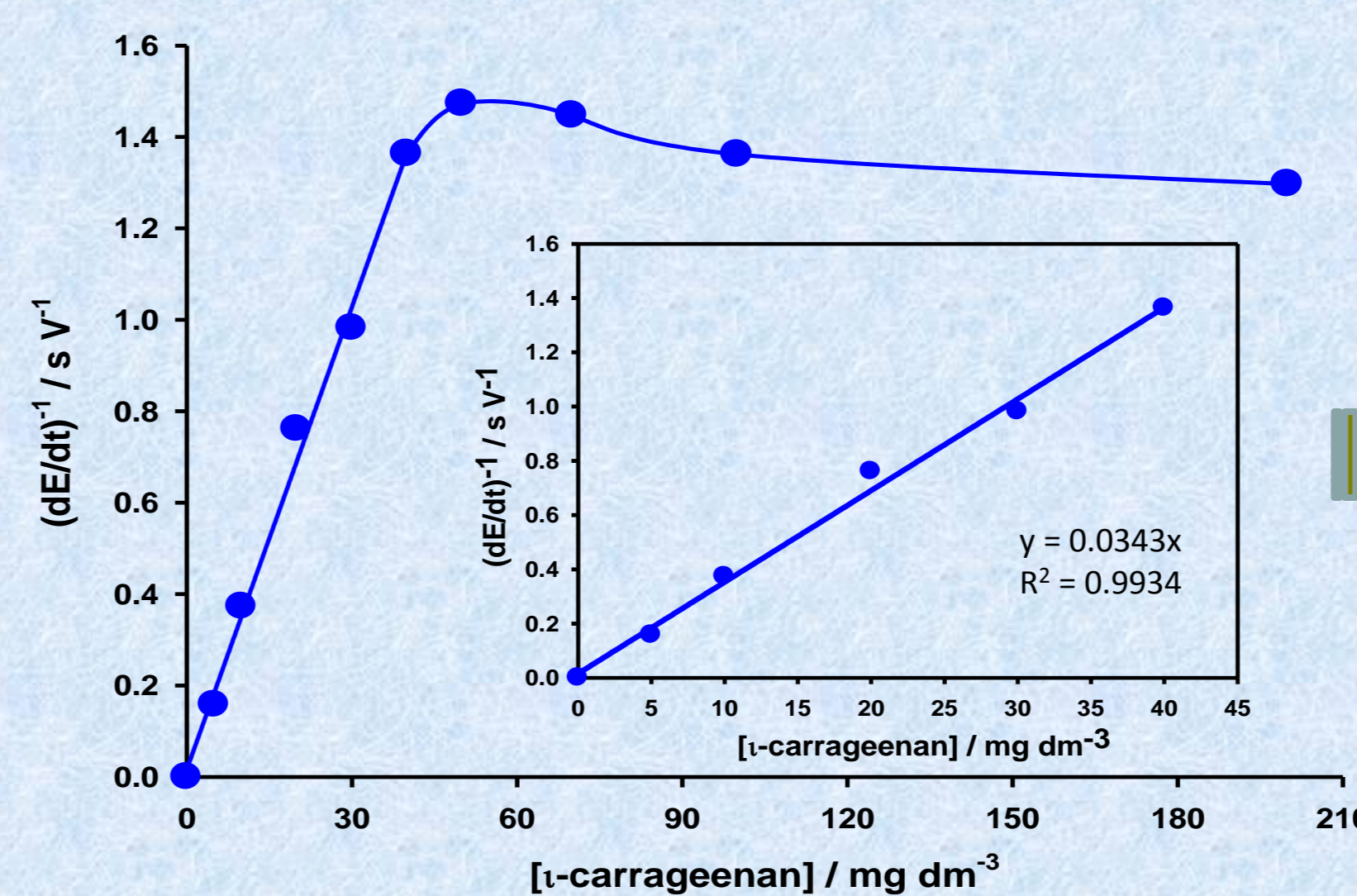
### CPSA

sensitive method for measurement of presodium "peak H"  
qualitative and quantitative determination of N-POM in seawater

### Peak H

additional parameter for the characterization of natural organic matter  
measured without any sample pretreatment

### CALIBRATION PLOT FOR ι-CARRAGEENAN



DETECTION LIMIT FOR ι-CARRAGEENAN  
4.1 mg dm⁻³ i.e. 8.2 nM

### POLYSACCHARIDES WITH SULPHATED GROUPS

electrochemically active molecules

produce at mercury drop electrode in buffered electrolyte  
"PEAK H<sub>PS</sub>" which is due to the catalytic hydrogen evolution

### SULPHATE RESIDUE

new type of groups responsible for the electrocatalysis