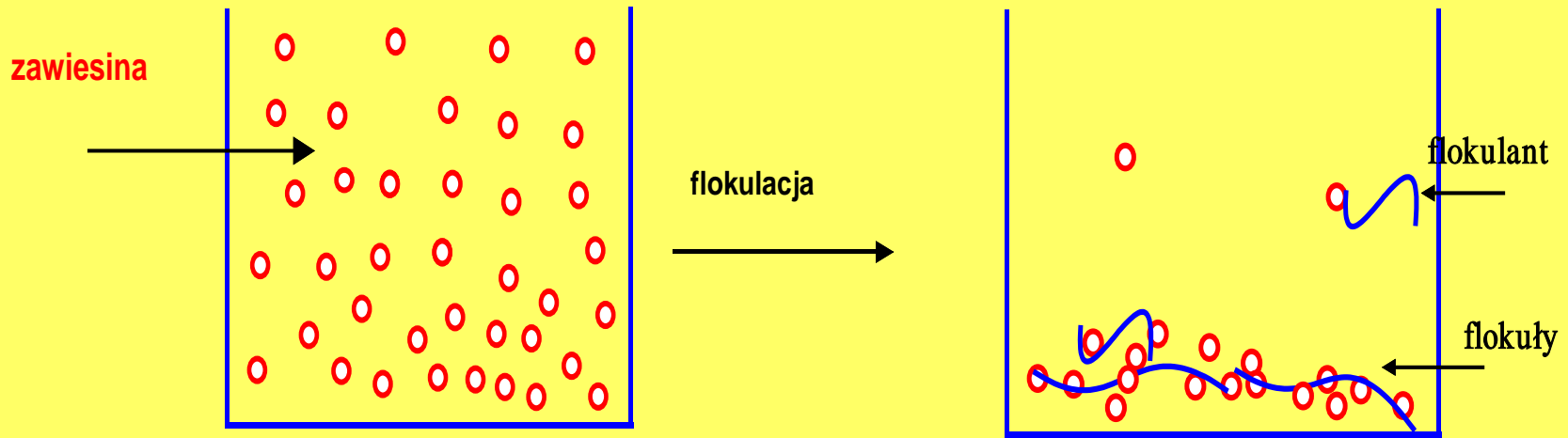


**PODSTAWY
MINERALURGII**

Wykład 15

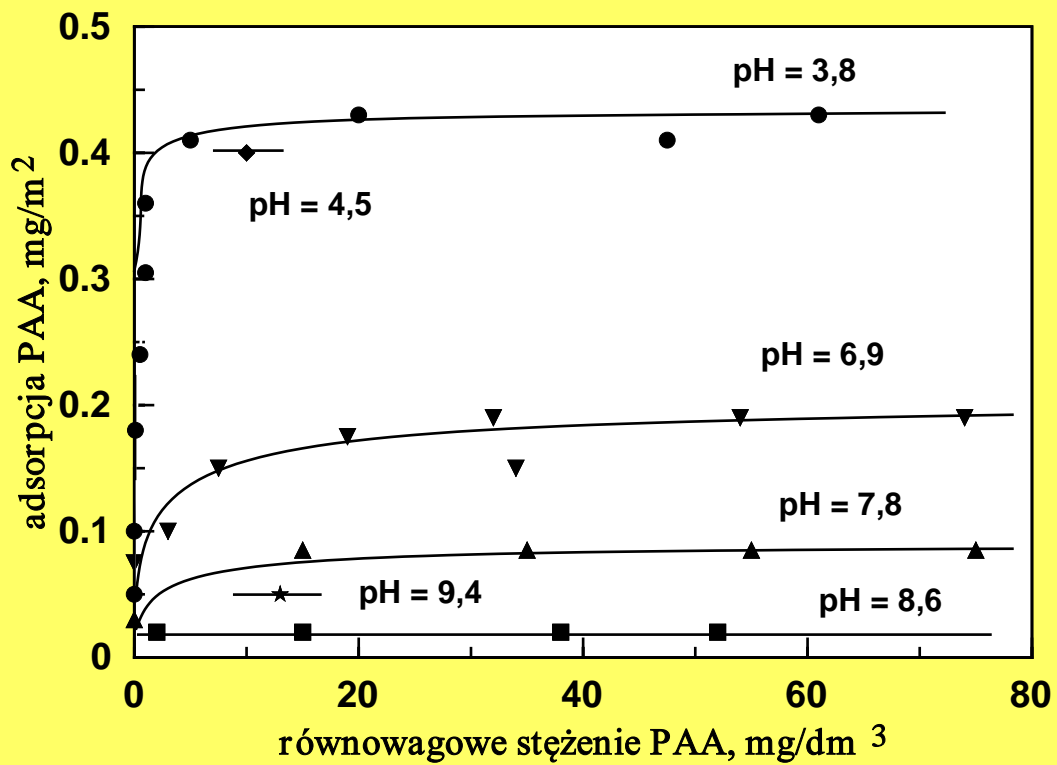
FLOKULACJA

Flokulacja jest procesem, w którym drobne ziarna, zdyspergowane w wodzie lub innej cieczy, ulegają agregacji pod wpływem związku wiążącego, zwanego *flokulantem*



Parametr główny: **zdolność do adsorpcji**

Adsorpcja polimerów



Adsorpcja

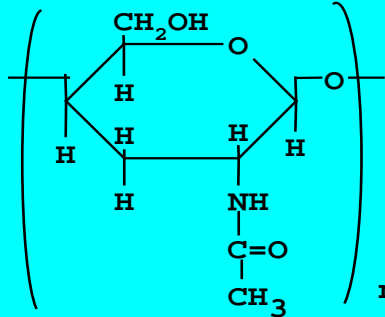
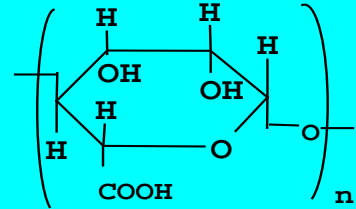
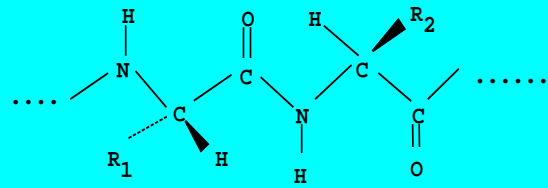
Układ	Γ_{plateau} , mg/m ²	Źródło
Fe ₂ O ₃ -PAM-pH = 5,2	1,01	Drzymała i Fuerstenau, 1987
Fe ₂ O ₃ -PAM-pH = 9,3	0,62	Drzymała i Fuerstenau, 1987
SiO ₂ -PAM-pH = 4,0	~0,35	Drzymała i Fuerstenau, 1987
SiO ₂ -PAM-pH = 9,8	~0,15	Drzymała i Fuerstenau, 1987
Fe ₂ O ₃ -PAA-pH = 3,8	0,43	Gebhardt i Fuerstenau, 1983
Fe ₂ O ₃ -PAA-pH = 7,8	0,08	Gebhardt i Fuerstenau, 1983
TiO ₂ -PAA-pH = 4,2	0,08	Gebhardt i Fuerstenau, 1983
SiO ₂ -PAA-pH = 7,0	~0	Gebhardt i Fuerstenau, 1983
Fe ₂ O ₃ -PAAM-pH = 3,8	0,61	Drzymała i Fuerstenau, 1987
grafit-PEO-pH = 9,1	0,80	Gochin i współ., 1985
antracyt-PEO-pH = 9,1	0,75	Gochin i współ., 1985
SiO ₂ -PAA-pH = 9,8	~0,15	Drzymała i Fuerstenau, 1987

PAA – poli(kwas alrylowy), PAM – poli(akryloamid) PAAM – polimer zawierający po połowie grup karboksylowych i amidowych, PEO – poli(tlenek etylenu).

Flokulanty naturalne

<p>Skrobia:</p> <p>amyloza</p> <p>amylopektyna</p>	<p>The diagram shows two repeating units of starch. The top unit, amylose, consists of two alpha-D-glucopyranose rings linked by an alpha-1,4-glycosidic bond. The bottom unit, amylopectin, consists of two alpha-D-glucopyranose rings linked by an alpha-1,4-glycosidic bond, with a side chain of two more alpha-D-glucopyranose rings attached to the second ring via an alpha-1,6-glycosidic bond. Both units are enclosed in large parentheses with a subscript 'n' and a bond extending from the oxygen atom of the glycosidic linkage.</p>
<p>Celuloza</p>	<p>The diagram shows a single repeating unit of cellulose, which is a beta-D-glucopyranose ring. The ring is enclosed in large parentheses with a subscript 'n' and a bond extending from the oxygen atom of the glycosidic linkage.</p>
<p>Guar</p>	<p>The diagram shows a repeating unit of guar, which consists of two alpha-D-glucopyranose rings linked by an alpha-1,4-glycosidic bond. A galactose ring is attached to the second alpha-D-glucopyranose ring via an alpha-1,6-glycosidic bond. The entire unit is enclosed in large parentheses with a subscript 'n' and a bond extending from the oxygen atom of the glycosidic linkage.</p>

Flokulanty naturalne

<p>Chityna</p>	 <p>The diagram shows the repeating unit of chitin, a polysaccharide. It consists of a six-membered pyranose ring in a chair conformation. The ring is enclosed in large parentheses with a subscript 'n' to the right. The C1 carbon is bonded to a hydrogen atom (H) pointing down and to the left, and to an oxygen atom (O) pointing up and to the right, which is part of the glycosidic linkage. The C2 carbon has a hydroxyl group (OH) pointing up and to the left. The C3 carbon has a hydrogen atom (H) pointing down and to the left. The C4 carbon has a hydrogen atom (H) pointing down and to the left. The C5 carbon is bonded to a hydrogen atom (H) pointing down and to the left, and to a nitrogen atom (NH) pointing down and to the right. The nitrogen atom is bonded to a carbonyl group (C=O) pointing down, which is further bonded to a methyl group (CH3) pointing down.</p>
<p>Alginiany</p>	 <p>The diagram shows the repeating unit of alginate, a polysaccharide. It consists of a six-membered pyranose ring in a chair conformation. The ring is enclosed in large parentheses with a subscript 'n' to the right. The C1 carbon is bonded to a hydrogen atom (H) pointing down and to the left, and to an oxygen atom (O) pointing up and to the right, which is part of the glycosidic linkage. The C2 carbon has a hydroxyl group (OH) pointing up and to the left. The C3 carbon has a hydrogen atom (H) pointing down and to the left. The C4 carbon has a hydrogen atom (H) pointing down and to the left. The C5 carbon is bonded to a hydrogen atom (H) pointing down and to the left, and to a carboxyl group (COOH) pointing down.</p> <p>(zawierają także grupy -OH, -SO₃H oraz -NH₂)</p>
<p>Białka</p>	 <p>The diagram shows a segment of a protein backbone. It consists of a chain of atoms: ... - N - C - C(=O) - N - C - C(=O) - The first nitrogen atom (N) is bonded to a hydrogen atom (H) pointing up. The first carbon atom (C) is bonded to a hydrogen atom (H) pointing down and to the right, and to a side chain labeled R₁ pointing down and to the left. The second carbon atom (C) is bonded to a hydrogen atom (H) pointing up and to the left, and to a side chain labeled R₂ pointing up and to the right. The second nitrogen atom (N) is bonded to a hydrogen atom (H) pointing down.</p>

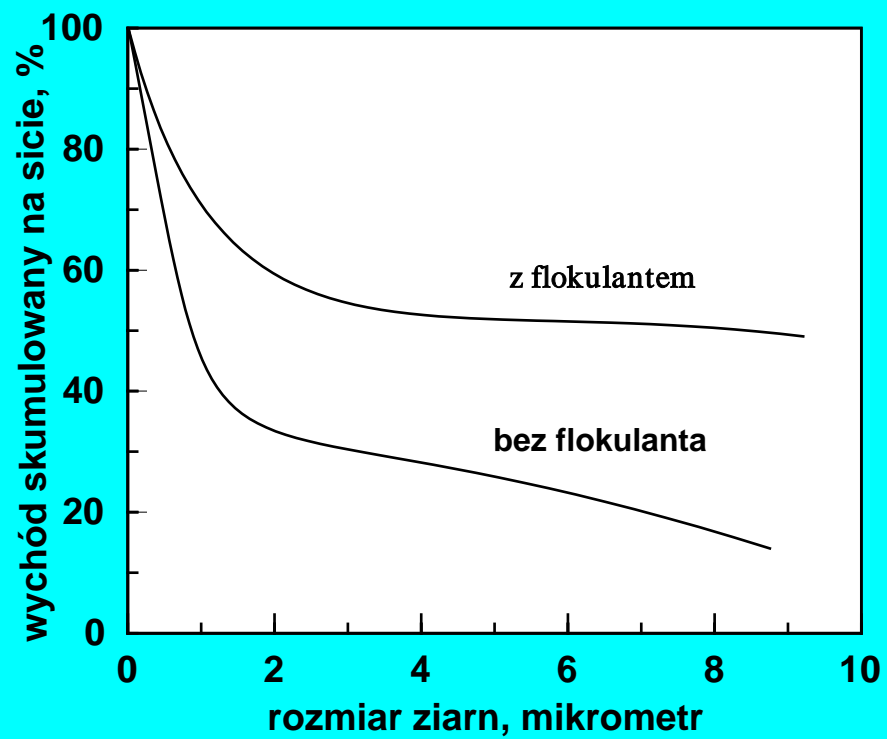
Flokulanty anionowe

Rodzaj flokulanta	Nazwa flokulanta	Wzór flokulanta
Karboksyłowe	kwas poliakrylowy i jego pochodne	$\left(\begin{array}{c} \text{R} \\ \\ \text{---CH}_2\text{---C---} \\ \\ \text{C=O} \\ \\ \text{O}^- \end{array} \right)_n$ <p>R = H, CH₃, itd.</p>
Sulfonowe	polistyrenosulfoniany	$\left(\begin{array}{c} \text{---CH}_2\text{---CH---} \\ \\ \text{C}_6\text{H}_4 \\ \\ \text{O} \leftarrow \text{S} \rightarrow \text{O} \\ \\ \text{O}^- \end{array} \right)_n$
Ksantogenianowe	ksantogenian celulozy ksantogenian skrobi	$\left(\begin{array}{c} \text{S} \quad \text{S}^- \\ \diagdown \quad / \\ \text{C} \\ \\ \text{O} \\ \\ \text{G} \end{array} \right)_n$ <p>G-OH oznacza D-glukozę w celulozie lub skrobi</p>
Fosfonowe	poliwinylofosfoniany	$\left(\begin{array}{c} \text{---CH}_2\text{---CH---} \\ \\ \text{P=O} \\ / \quad \backslash \\ \text{O}^- \quad \text{O}^- \end{array} \right)_n$

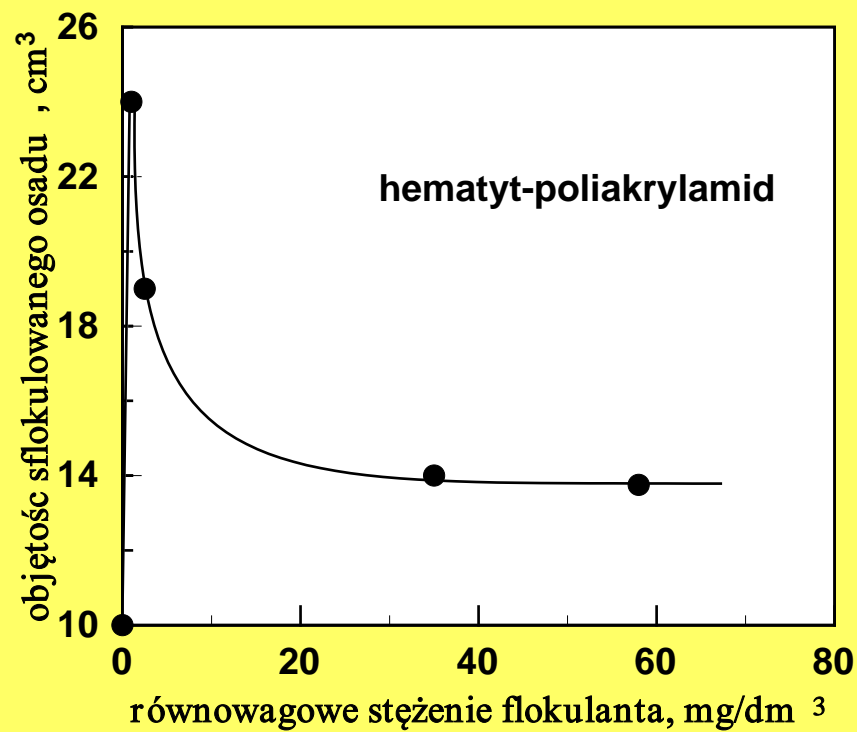
Flokulanty kationowe

Rodzaj flokulanta	Nazwa flokulanta	Wzór flokulanta
Amoniowe	poli(chlorek etylenoimina)	$\left(\text{CH}_2 - \text{CH}_2 - \overset{\text{Cl}^-}{\overset{+}{\text{N}}\text{H}_2} \right)_n$
	poli(chlorek N-metylo-4-winylo- pirydyny)	$\left(\text{CH}_2 - \underset{\text{CH}_3}{\overset{\text{N}^+ \text{Cl}^-}{\text{C}_5\text{H}_4}} \right)_n$
	poli(chlorek 2-metakrylooxyetylo-trimetyloamoniowy)	$\left(\text{CH}_2 - \overset{\text{CH}_3}{\text{C}} \left(\begin{array}{c} \text{C}=\text{O} \\ \\ \text{O} \\ \\ \text{CH}_2 \\ \\ \text{N}^+ \\ / \quad \backslash \\ \text{CH}_3 \quad \text{CH}_3 \end{array} \right) \right)_n$
Sulfoniowe	poli(chlorek 2-akryloxy- etylo-dimetylosulfoniowy)	$\left(\text{CH}_2 - \underset{\text{CH}_3}{\overset{\text{S}^+ \text{Cl}^-}{\text{C}_2\text{H}_5}} \right)_n$
Fosfoniowe	poli(chlorek glycydylo-tributylofosfoniowy)	$\left(\text{O} - \text{CH}_2 - \underset{\text{Bu}}{\overset{\text{P}^+ \text{Cl}^-}{\text{C}_2\text{H}_4}} \right)_n$

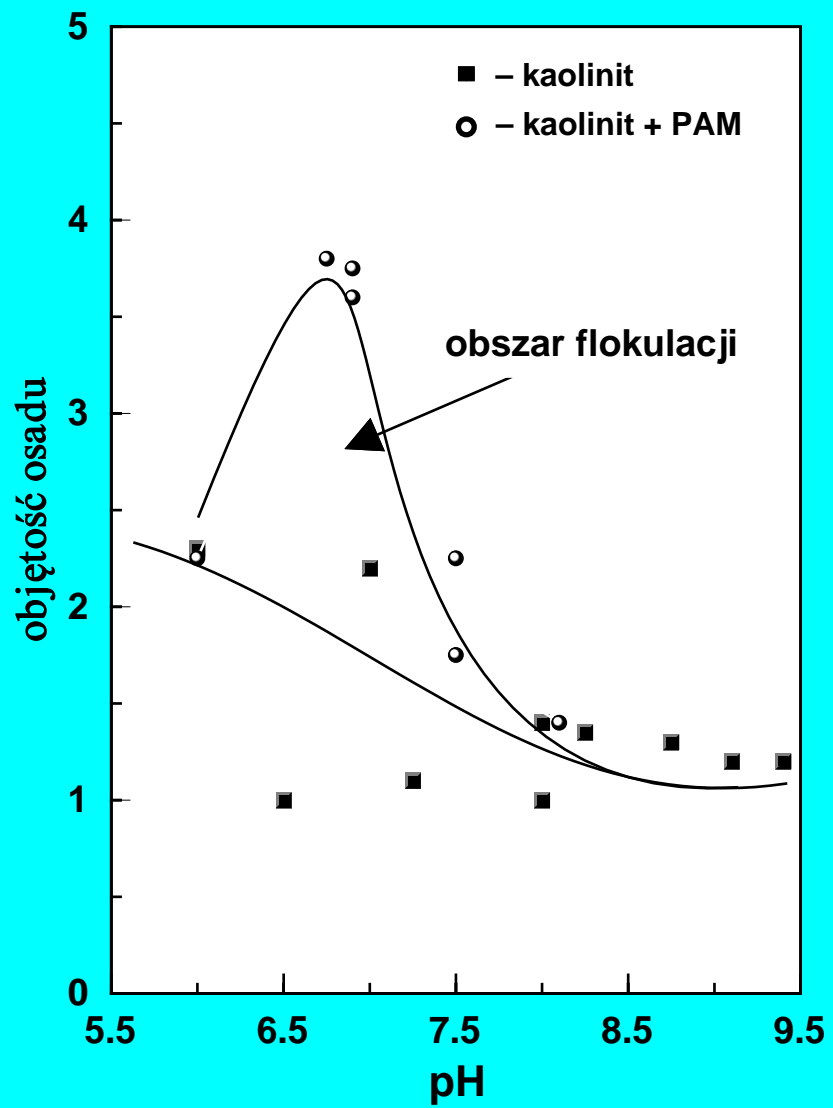
Flokulacja



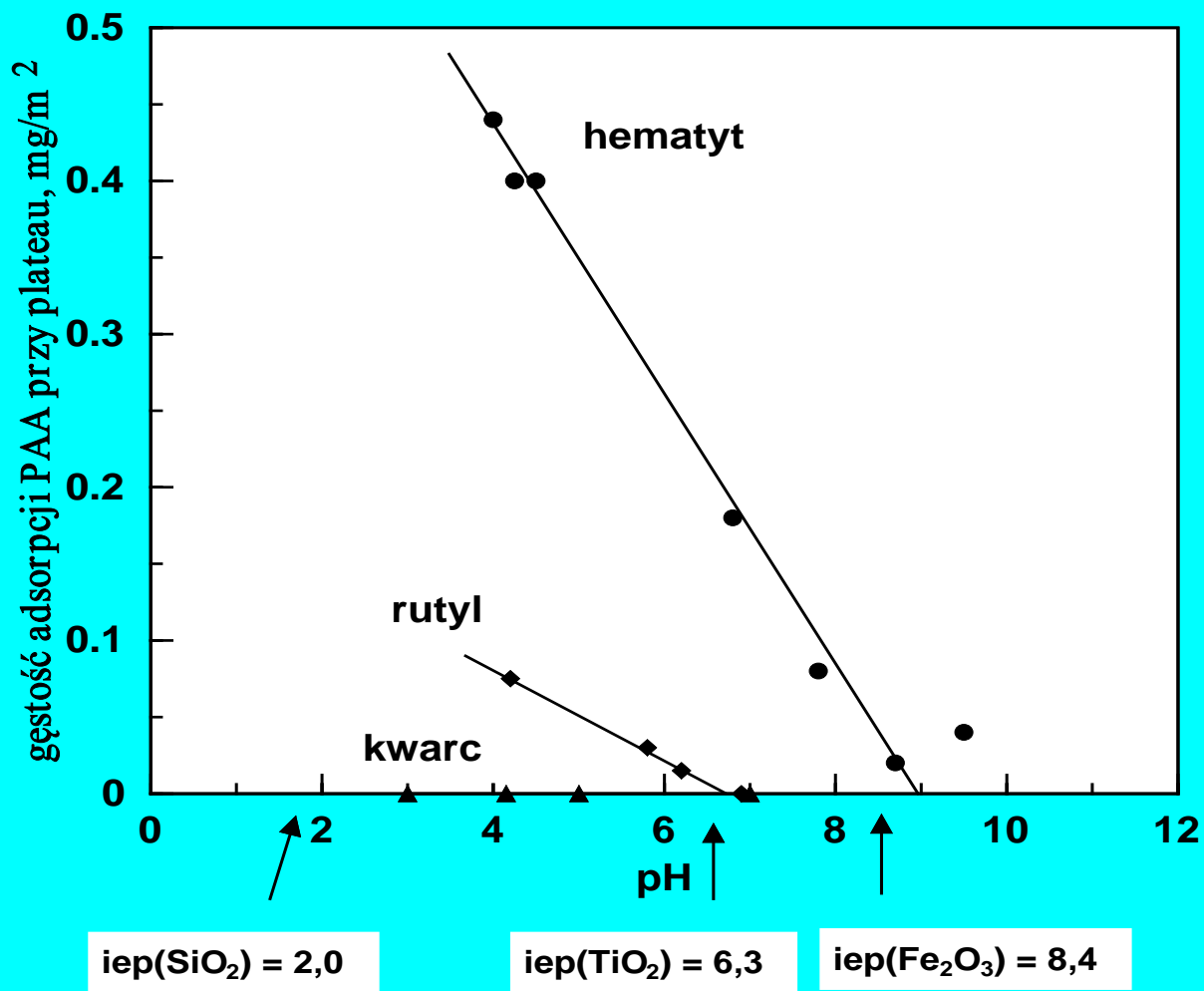
Flokulacja



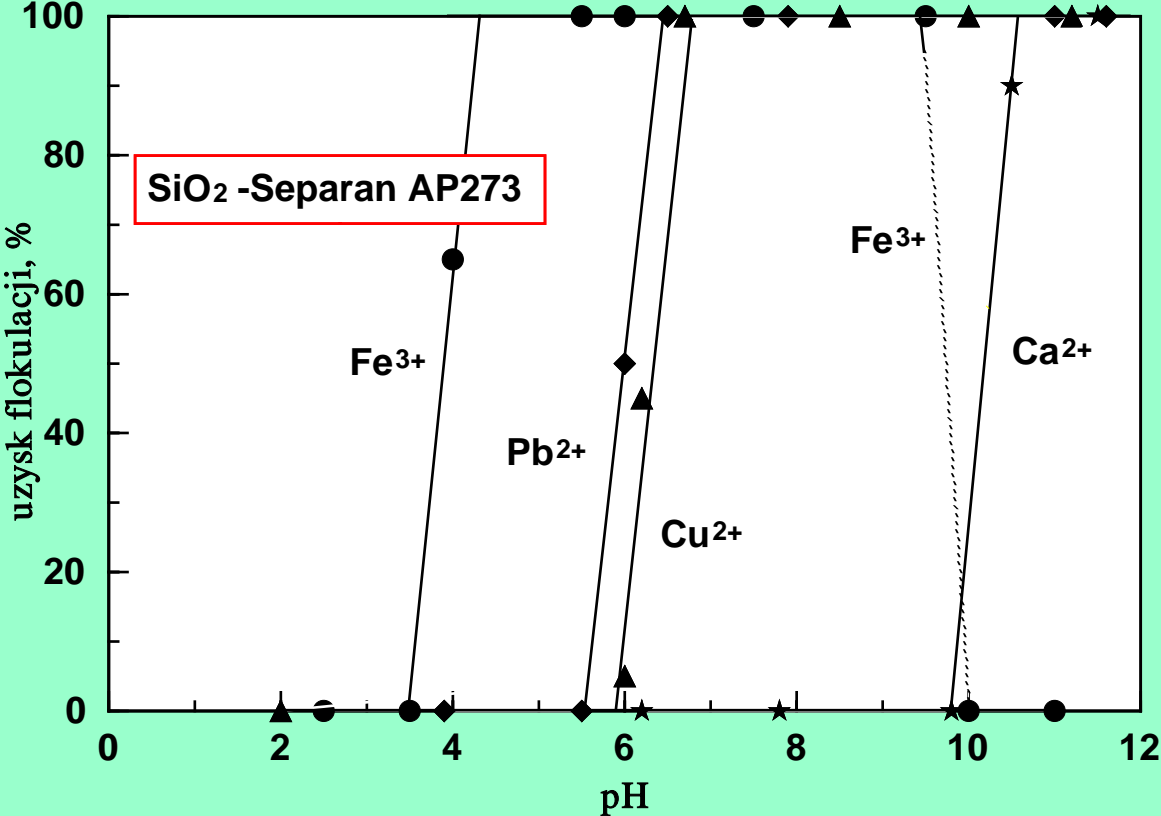
Flokulacja



Wpływ iep na adsorpcję i flokulacje



Flokulacja



Restabilizacja



