

PRIRODOSLOVNO-MATEMATIČKI FAKULTET  
Kemijski odsjek

# MOLEKULSKA ANIONSKA PUMPA

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Student I. godine Doktorskog sveučilišnog studija KEMIJA – smjer ORGANSKA KEMIJA

Kemijski seminar I

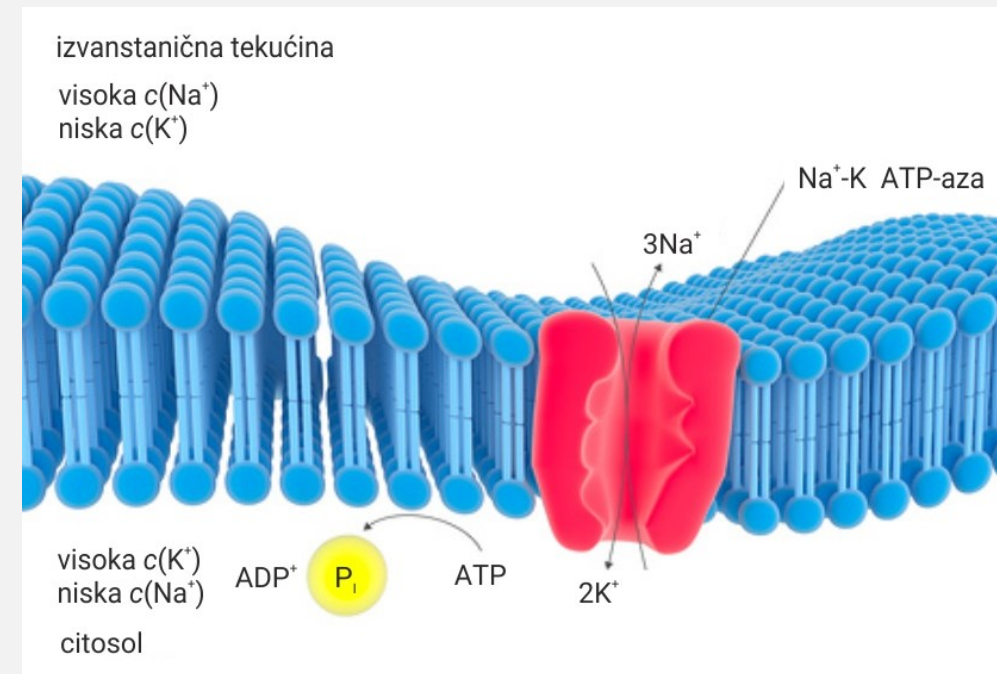
Seminar izrađen prema:

B. Shao, H. Fu, I. Aprahamian, *Science* **385** (2024) 544–549.

Zagreb, 2025. godina.

# UVOD

- Biološki transport iona i prirodne pumpe
  - Aktivni
    - ATPaze
  - Pasivni
    - Ionski kanali
    - Prijenosnici
- Ovisi o koncentracijskim gradijentima i membranskim potencijalima



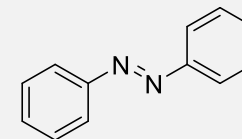
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(pristupljeno 9.3.2025.)

# UVOD

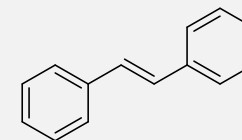
- Razvoj umjetnih molekulskih pumpi
  - Supramolekulska kemija
  - Fotosklopke
- Mehanizmi djelovanja sintetičkih ionskih pumpi
  - Supramolekulske interakcije
  - Elektrokemijski gradijent
  - Fotokemijski inducirane promjene konformacije

- Fotosklopke u funkciji molekularnih pumpi

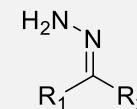
- Azobenzeni



- Stilbeni



- Hidrazoni

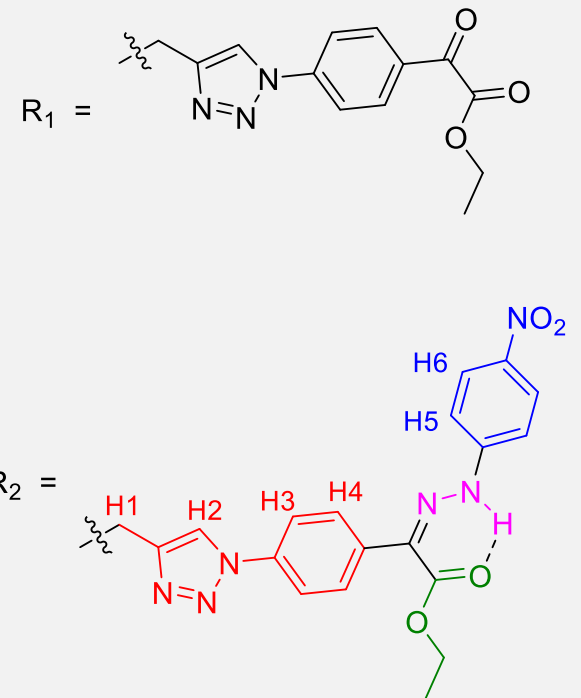
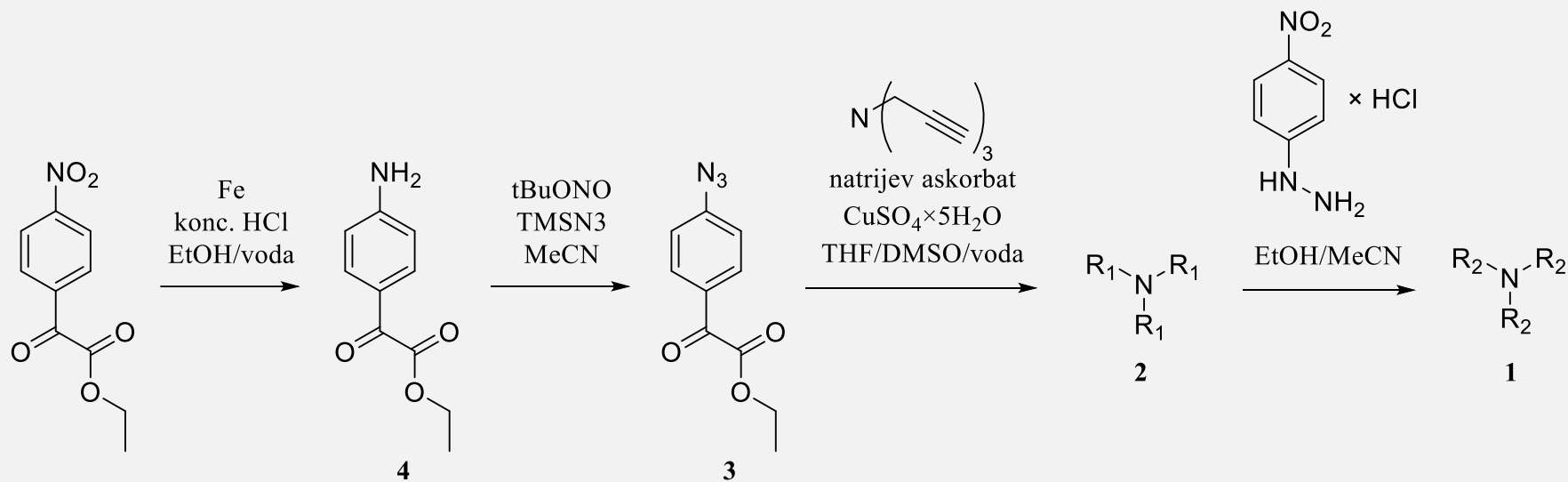


T. Mei, H. Zhang, K. Xiao, *ACS Nano* **16** (2022) 13323–13338.

I. Aprahamian, *ACS Cent. Sci.* **6** (2020) 347–358.

K. D. Garlid, *Encyclopedia of Biological Chemistry*, Elsevier, Oregon, 2004., 405–412.

# METODE SINTEZE I KARAKTERIZACIJE SPOJEVA



# METODE SINTEZE I KARAKTERIZACIJE SPOJEVA

- Spektroskopske metode

- NMR

- $^1\text{H}$  NMR

- $^{13}\text{C}$  NMR

- 2D NMR tehnike

- DOSY NMR

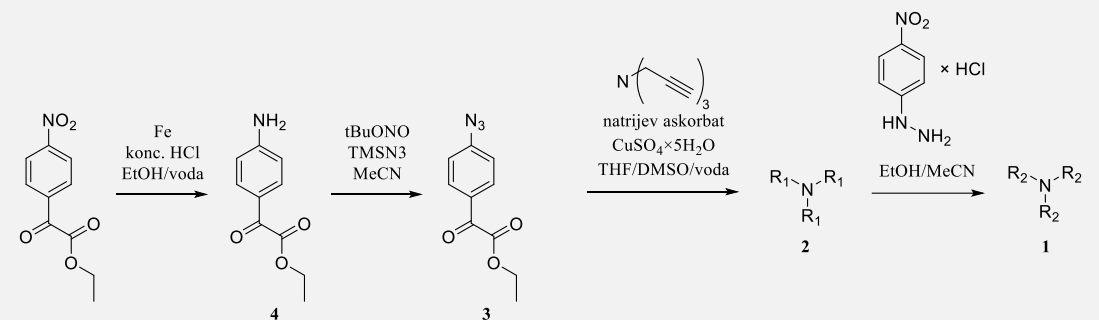
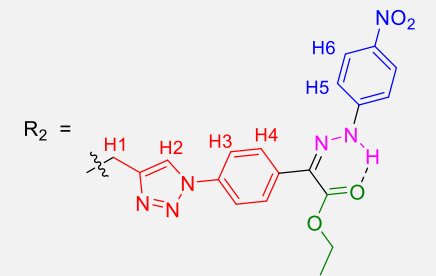
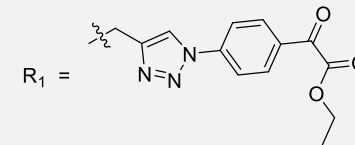
- Izotermna titracijska kalorimetrija

- MS

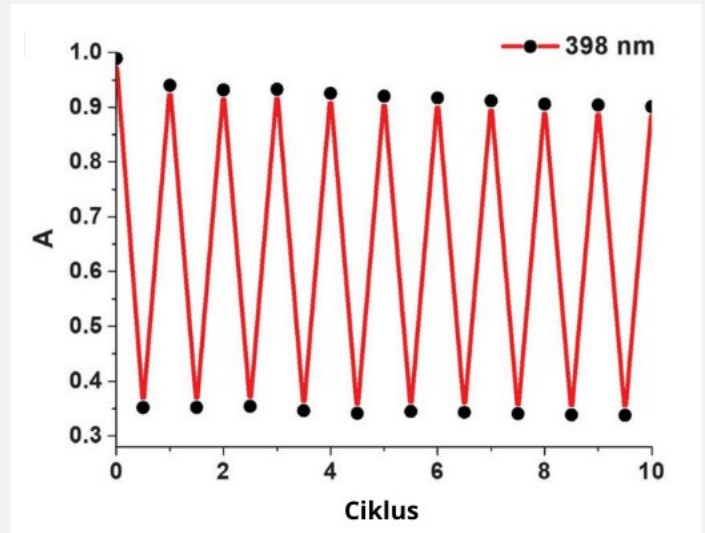
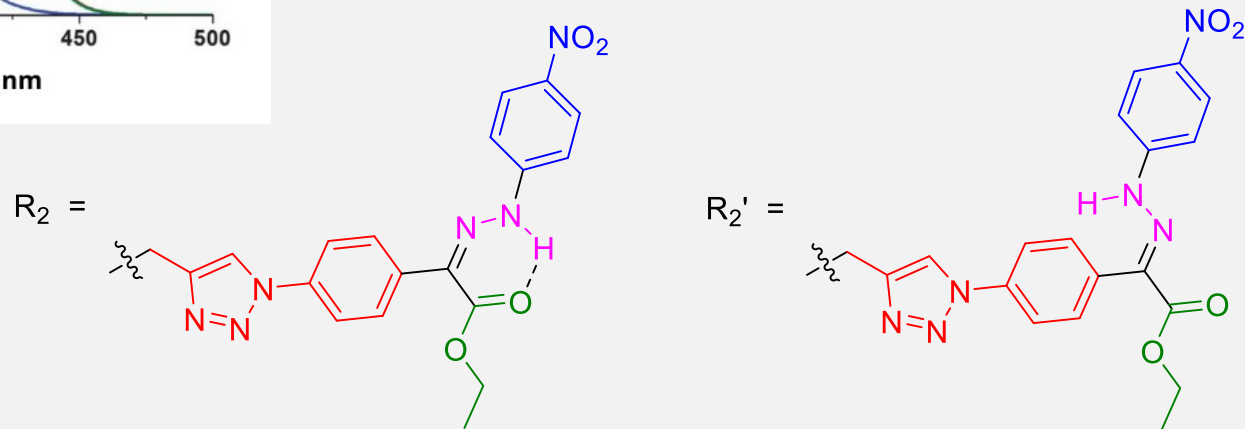
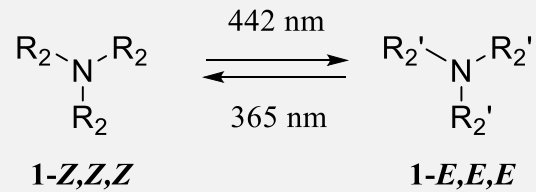
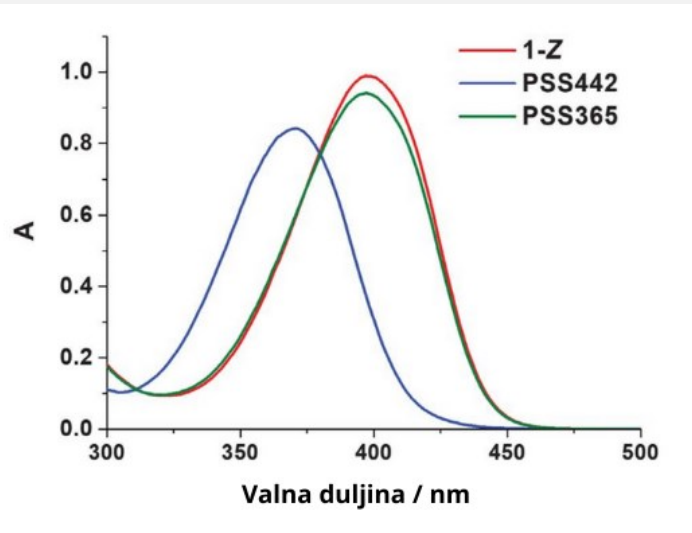
- IR

- UV-Vis

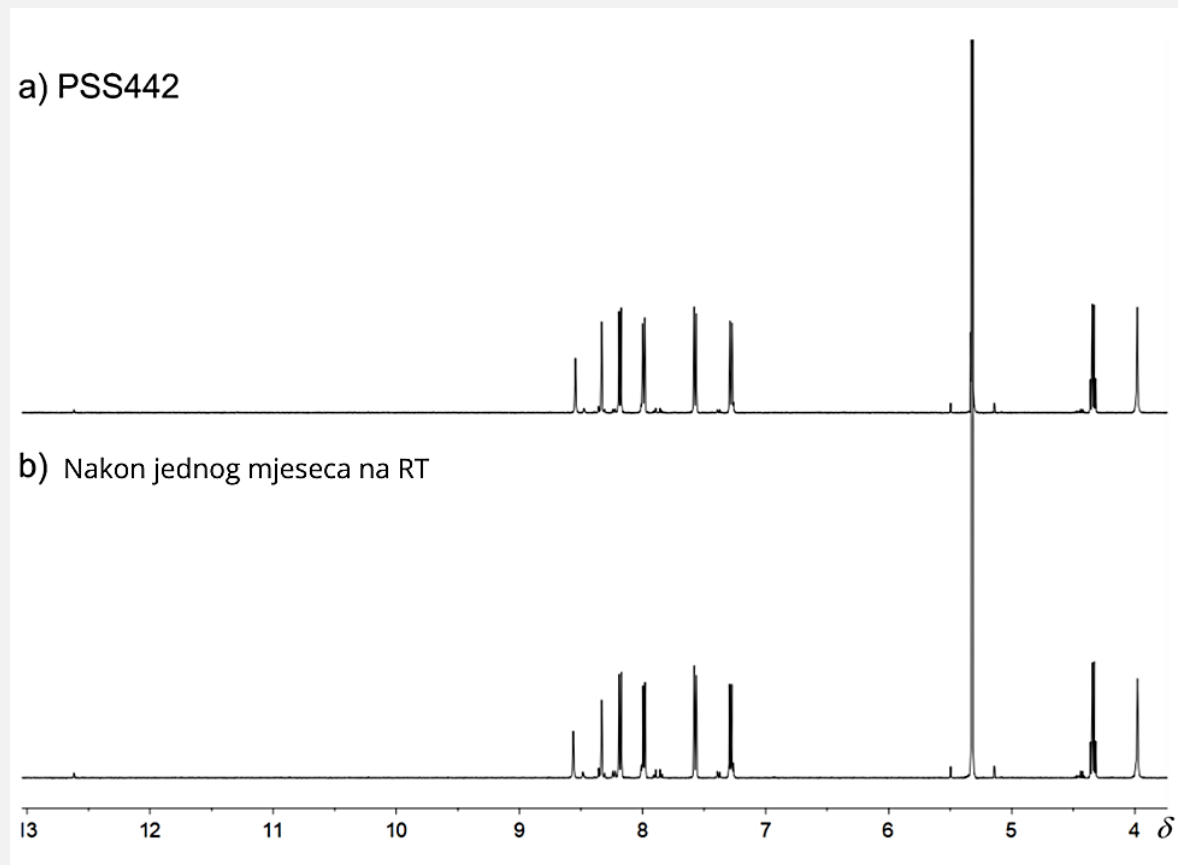
- Kemijska aktinometrija



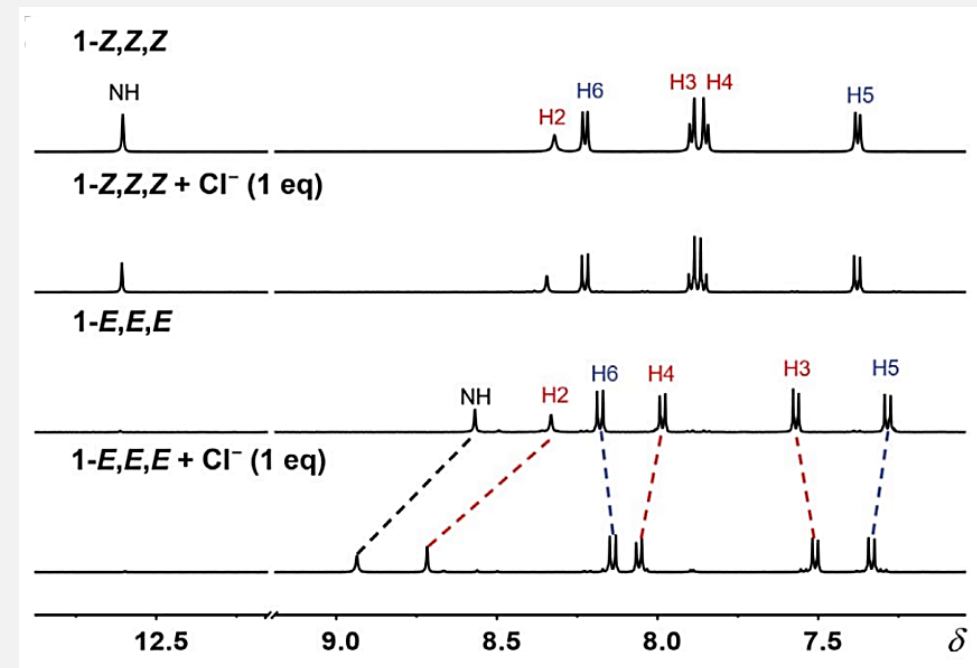
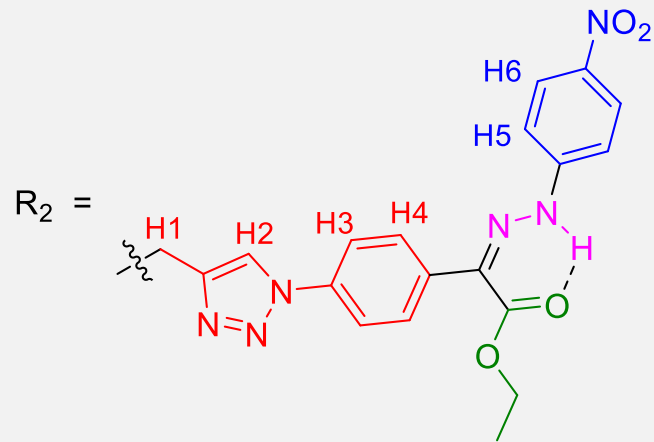
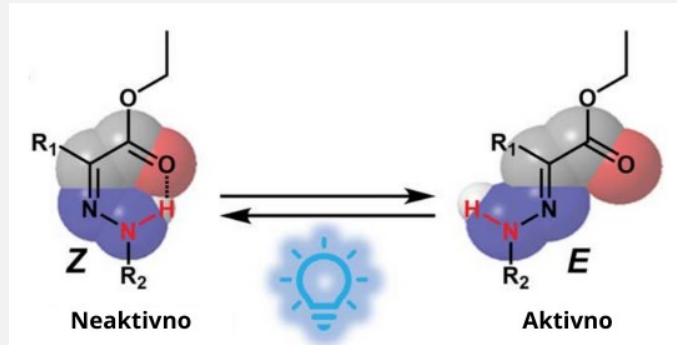
# ANALIZA PODATAKA I REZULTATA -FOTOIZOMERIZACIJA-



# ANALIZA PODATAKA I REZULTATA -TEMPERATURNNA STABILNOST I FAZNE TRANSFORMACIJE-

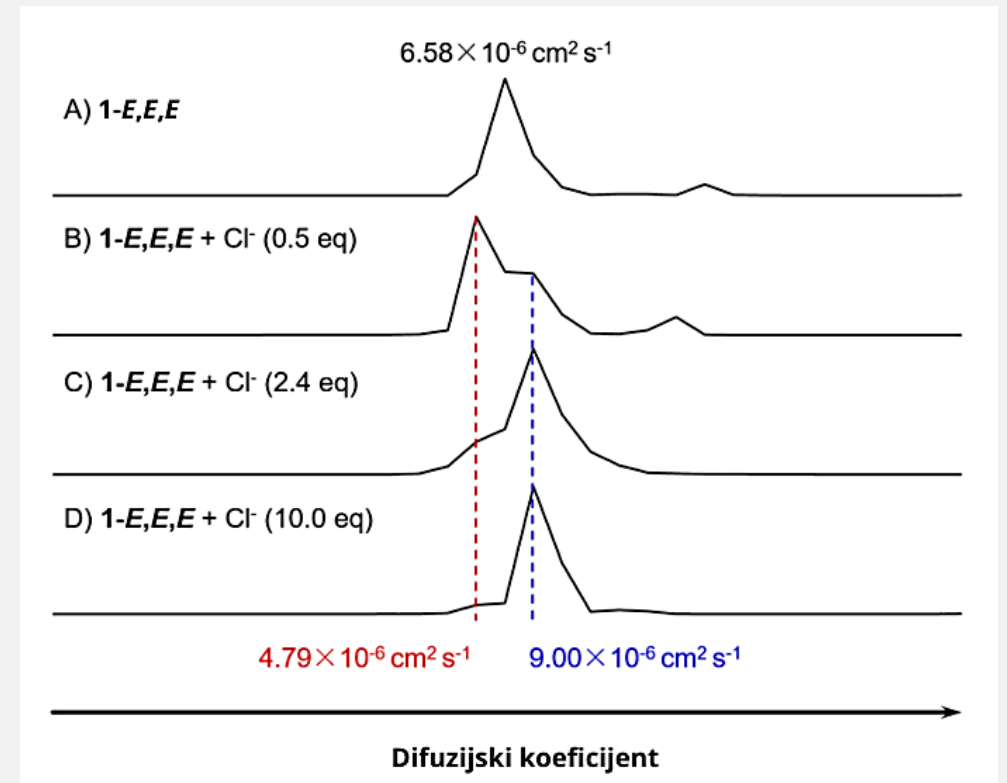
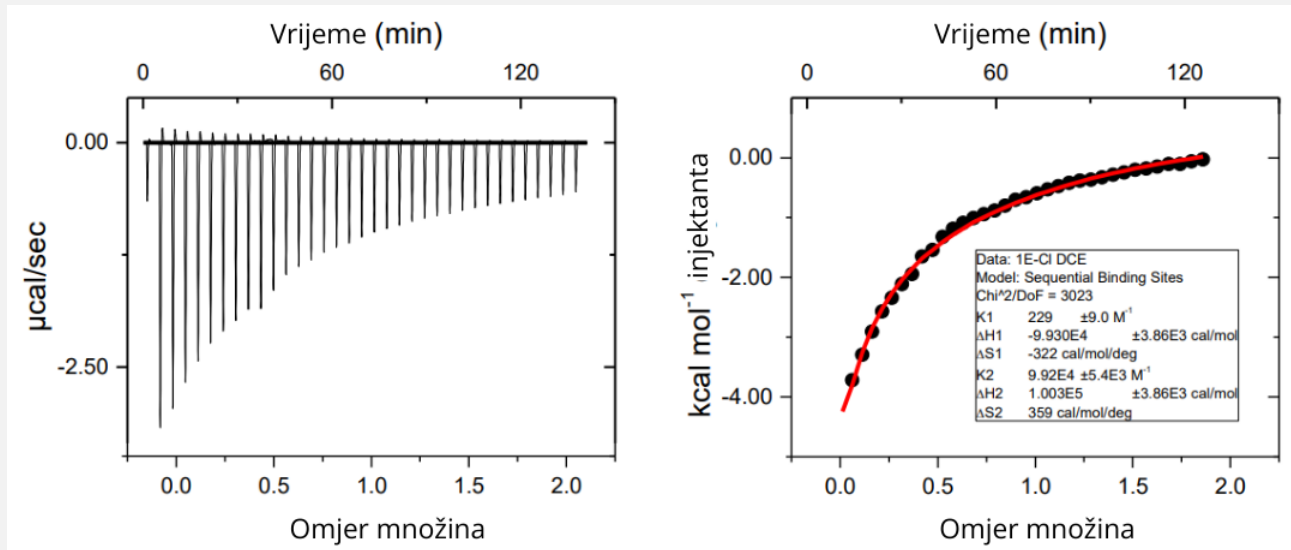


# ANALIZA PODATAKA I REZULTATA - AFINITET VEZANJA ANIONA NA HIDRAZONSKI RECEPTOR -





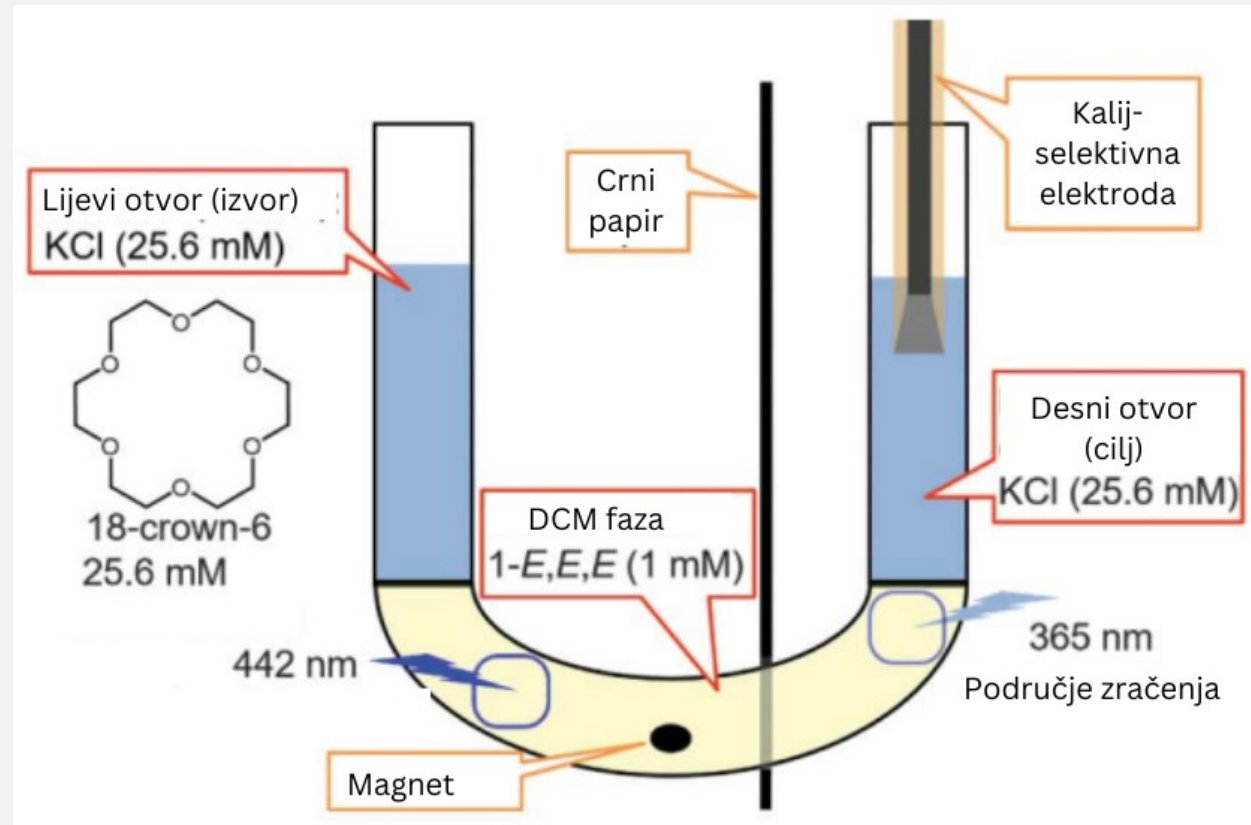
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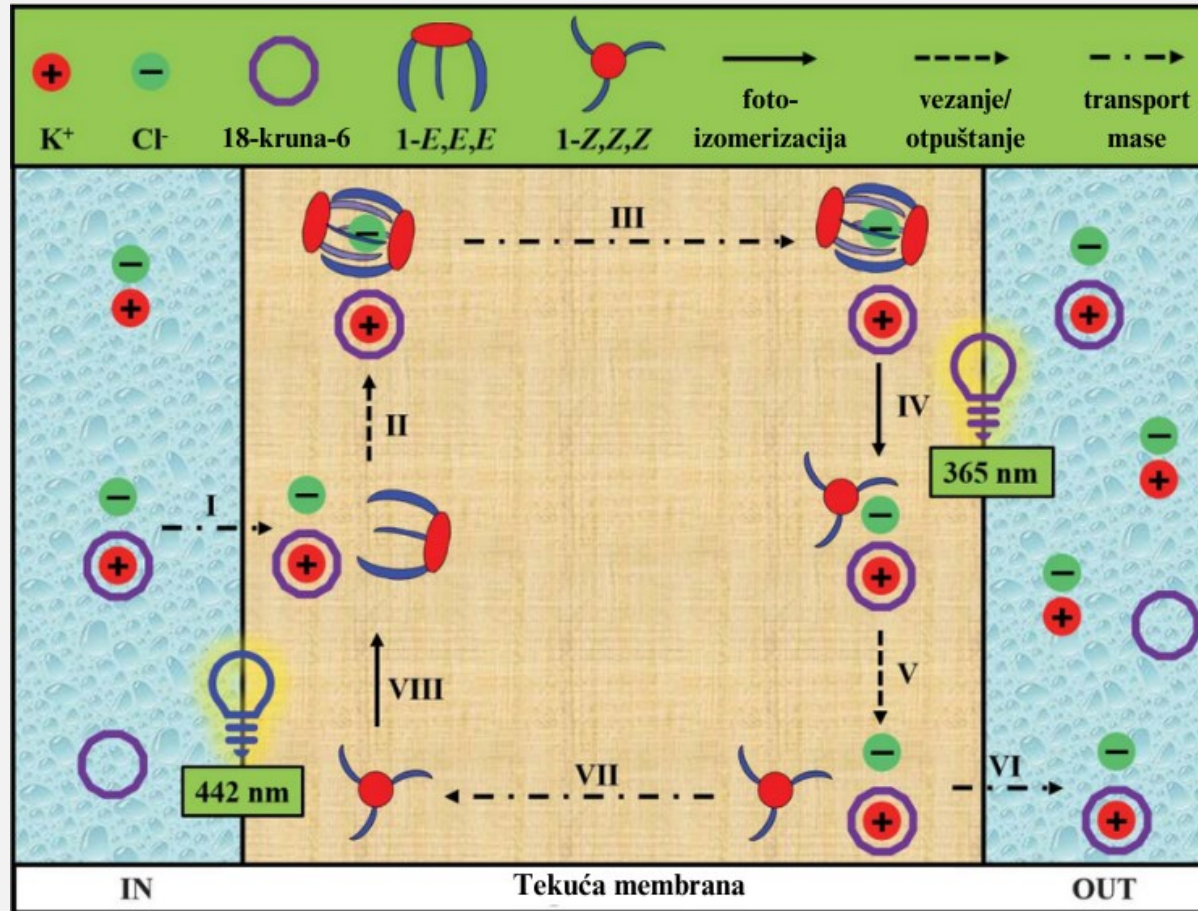
# ANALIZA PODATAKA I REZULTATA - AFINITET VEZANJA ANIONA NA HIDRAZONSKI RECEPTOR -

Konfiguracija	Anion	Omjer receptora I i aniona	Konstanta vezanja
<b>I-E,E,E</b>	Cl <sup>-</sup>	2:1	$2,05 \pm 0,14 \times 10^6 \text{ M}^{-2}$
	Br <sup>-</sup>	2:1	$1,48 \pm 0,13 \times 10^6 \text{ M}^{-2}$
	I <sup>-</sup>	2:1	$5,96 \pm 0,48 \times 10^5 \text{ M}^{-2}$
	BF <sub>4</sub> <sup>-</sup>	1:1	$9,57 \pm 0,59 \times 10^2 \text{ M}^{-1}$
	PF <sub>6</sub> <sup>-</sup>	1:1	$6,50 \pm 0,06 \times 10^2 \text{ M}^{-1}$
<b>I-Z,Z,Z</b>	Cl <sup>-</sup>	1:1 (pretpostavljeno zbog jako slabih interakcija)	$9 \pm 1 \text{ M}^{-1}$
	Br <sup>-</sup>		$7 \pm 1 \text{ M}^{-1}$
	I <sup>-</sup>		$2 \pm 1 \text{ M}^{-1}$

# ANALIZA PODATAKA I REZULTATA -ISPITIVANJE TRANSPORTA IONA U U-CIJEVI-



# ANALIZA PODATAKA I REZULTATA -ISPITIVANJE TRANSPORTA IONA U U-CIJEVI-



# ZAKLJUČAK

- Umjetni sustav za prijenos iona
- Fotoizomerizacija → selektivan prijenos aniona
- **Ključni rezultati:**
  - Visoka selektivnost za halogenide
  - Precizna kontrola izomerizacije *E-Z* izomera vanjskim podražajima
  - Učinkovit transport pod utjecajem svjetlosti
- **Moguće primjene:**
  - Pročišćavanje vode
  - Separacija iona
  - Biomedicina (regulacija ionskih procesa u stanicama)
- **Buduća istraživanja:**
  - Optimizacija kinetike
  - Poboljšanje stabilnosti u biološkim uvjetima
  - Integracija u funkcionalne membrane

HVALA NA PAŽNJI!