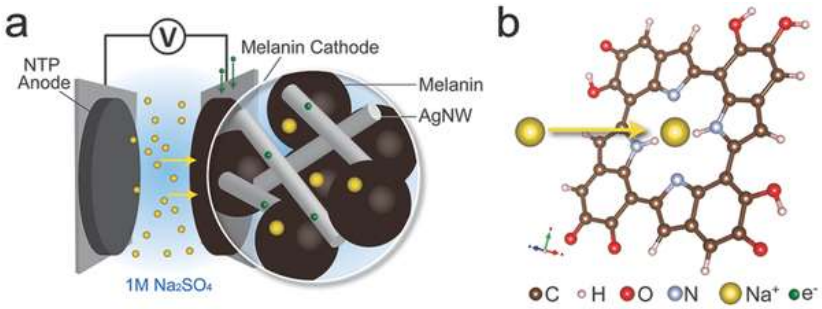
This website uses cookies to ensure you get the best experience on our website. More info

Researchers discover melanin could make for great batteries

May 17, 2016 by Emily Durham, Carnegie Mellon University Mechanical Engineering



Credit: Carnegie Mellon University Mechanical Engineering

Melanin is best known as the pigment that dictates our skin tones, but it is found just about everywhere—in our brains, in our hair. It is even found in cuttlefish. But as abundant as melanin is, its exact macromolecular chemical structure is surprisingly not well understood.

Though researchers have extensively studied the chemical structure of individual melanin molecules for more than 70 years, relatively little is known about the molecular building blocks that form complex melanin pigments. But a team of researchers from Carnegie Mellon University has discovered that the chemical structure of melanin on a macromolecular scale exhibits, amongst other shapes, a four-membered ring—in other words, a chemical structure that may be conducive to creating certain kinds of batteries based on natural melanin pigments.

"Functionally, different structures of melanin have quite different chemistries, so putting them together is a little like solving a jigsaw puzzle, with each molecule a puzzle piece," explains Assistant Professor of Mechanical Engineering and co-author of the study Venkat Viswanathan. "You could take any number of these pieces and mix and match them, even stack them on top of each other. So the question we tried to answer was, which of these arrangements is the most stable?

There are several possible configurations for melanin with each having a different function depending on its chemical structure. When these molecules bind to form a macromolecular structure, or a polymer, these polymers can be arranged to create a potential battery material. Based on the readings the researchers gained from their experiment, they discovered that a tetramer structure, a four-membered ring composed of larger molecules, appears to be consistent with the structural model of melanin macromolecules.

"Only the tetramer structure had the correct number of exposed nitrogens to bind with the sodium," says Associate Professor of Materials Science and Engineering and Biomedical Engineering Chris Bettinger, "and the voltage signals we received are consistent with what you would observe if you believe that the tetramer is the correct structural model."

The research team—which included Bettinger, materials science engineering postdoctoral researcher Young Jo Kim, and Jay Whitacre, professor of

Featured Last comments Popular


New research suggests evolution might favor 'survival of the laziest' Aug 21, 2018 21


Ice confirmed at the Moon's poles Aug 21, 2018 11


Research team finds evidence of matter-matter coupling Aug 23, 2018 1


A novel graphene quantum dot structure takes the cake Aug 23, 2018 2


Stars memorize rebirth of our home galaxy Aug 22, 2018 5

more »

Phys.org on Facebook

Like 1.4M people like this. Sign Up to see what your friends like.

Email newsletter

email Subscribe

Relevant PhysicsForums posts

Why is iron added to the head of a match? 18 hours ago

Lemonade bomb (spoiler alert for "The Foreigner") Aug 22, 2018

In coordinate bond, why doesn't the H^ atom get a negative charge? Aug 22, 2018

Is 'C' a mono-atomic molecule? Aug 20, 2018

materials science and engineering and of engineering and public policy—was able to discover the tetramer structure of melanin by using it as a battery's cathode. However, in doing so, they also discovered that melanin exhibits a two-voltage plateau characteristic of normal battery materials, while outputting a surprisingly high voltage.

"The voltage we got out was high—comparable to what you would get for the best sodium-based cathode materials we would use in a battery," says Viswanathan. "So this was surprising to us: that we could take this material from biology, and it could function potentially as a very good cathode material."

Read the full article, **"Evidence of porphyrin-like structures in natural melanin pigments using electrochemical fingerprinting,"** in *Advanced Materials*. The research team also included visiting Ph.D. student Abhishek Khetan, Ph.D. student of Materials Science & Engineering Wei Wu, and collaborator Sang-Eun Chun of the University of Oregon.

Explore further: **Research team uses melanin to make biodegradable battery anode**

More information: Young Jo Kim et al. Evidence of Porphyrin-Like Structures in Natural Melanin Pigments Using Electrochemical Fingerprinting, *Advanced Materials* (2016). **DOI: 10.1002/adma.201504650**

Journal reference: Advanced Materials

Provided by: Carnegie Mellon University Mechanical Engineering

What's the difference between neutral and stable?
Aug 19, 2018

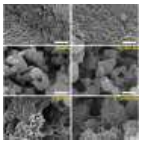
If NH4 is the cation, then what is the anion of it?
Aug 19, 2018

More from Chemistry

1946 shares

feedback to editors

Related Stories



Research team uses melanin to make biodegradable battery anode December 10, 2013

(Phys.org) —A team of researchers from Carnegie Mellon University and the University of Oregon has used melanin as an ingredient in a cocktail that led to the creation of a biodegradable battery anode. In their paper published ...

Fungal spores could 'hijack' human immune cells to spread infection April 28, 2016

Scientists have announced a major breakthrough in their understanding of how the fungus Aspergillus terreus - the cause of serious illness in humans - can move around the body, rather than remaining in the lungs as with similar ...

Recommended for you

Shape-shifting material can morph, reverse itself using heat, light August 24, 2018

A new material developed by University of Colorado Boulder engineers can transform into complex, pre-programmed shapes via light and temperature stimuli, allowing a literal square peg to morph and fit into a round hole before ...

Self-healing reverse filter opens the door for many novel applications August 24, 2018

A self-healing membrane that acts as a reverse filter, blocking small particles and letting large ones through, is the "straight out of science fiction" work of a team of Penn State mechanical engineers.

2 comments

2.5 Adjust slider to filter visible comments by rank

Display comments: **newest first**

PPihkala 5 / 5 (1) May 18, 2016

There is another article about using melanin as anode: http://phys.org/n...tml#nRlv
So will the next step be using it as both anode and cathode material?

compose

May 18, 2016

This comment has been removed by a moderator.

Commenting is closed for this article.

We recommend

Family Fun in Toronto!
Chest Physician

Family Fun in Toronto!
Chest Physician

Would JISAKOS have published Darwin?
C Niek van Dijk, Journal of ISAKOS: Joint Disorders & Orthopaedic Sports Medicine

New CHEST Membership Model Now in Effect
Chest Physician

5 Ways Locum Tenens Practice Can Prevent Physician Burnout
Weatherby Healthcare

8 Reasons Why It's Not So Bad to Work Over the Holidays - CompHealth
CompHealth

Powered by TRENDMD

Top	Help	Science X Account	Feature Stories	Android app	Connect
Home	FAQ	Sponsored Account	Latest news	iOS app	
Search	About	Newsletter	Week's top	Amazon Kindle	
Mobile version	Contact	RSS feeds	Archive	Push notification	

© Phys.org 2003 - 2018, Science X network

Privacy Policy Terms of Use