Chemistry Honors/ First Block

27 October 2014

Antioxidants and Their Effect on Free Radicals

Human physiology consists of many different types of molecules that react with each other in various ways, some for good and some for bad. One good reaction that benefits the body is the relationship between free radicals and antioxidants. The intake of antioxidants prevents the uncontrollably formation of free radicals. Studies have proven that antioxidants may be helpful in curing diseases or illnesses by using antioxidant treatments. In the reaction that takes place between antioxidants and free radicals, the geometric shapes changes throughout the process which is important in determining the reasoning the atoms work together.

Free radicals are atoms or groups of atoms with an unpaired number of electrons that can be formed when oxygen interacts with certain molecules. This creates energy which is released through reactions with neighboring molecules, such as proteins, lipids, carbohydrates, and nucleic acids. Antioxidants are molecules which can safely interact with free radicals and terminate the chain reaction before vital molecules such as DNA are damaged (Antioxidants and Free). Free radicals can be defined as reactive chemical species having a single unpaired electron in an outer orbit. Free radicals can cause "oxidative stress," a process that can trigger cell damage that can actually cause illnesses such as cancer, diabetes, and cardiovascular disease (Antioxidants and Health). There is an importance for the consumption of antioxidants within our diet such as beta-carotene, vitamin C, and vitamin E that binds to and reduces the destructive activities of aqueous

peroxyl radicals. The amount of free radicals is decreased by antioxidants therefore improving the overall health of the person.

The interplay between free radicals, antioxidants, and co-factors is important in maintaining health, aging and age-related diseases. Parkinson's Disease is one of the major progressive neurological disorders for which no preventative or long-term effective treatment strategies are available (Result). Parkinson's Disease is a progressive disorder of the nervous system that affects your movement (Parkinson's). Since there is evidence that free radical damage is involved in Parkinson's Disease, Vitamin E, a potent antioxidant was studied in people with early Parkinson's Disease in the 1980's by Shumin Zhang(Antioxidants: Vitamin). According to Zhang's studies, his team gathered detailed information on the diets of 76,890 women and 47,331 men enrolled in two huge studies of diet and health, both studies enrolled healthcare workers. Compared with those who ate the fewest servings of vitamin E-filled food, those who ate the most had 32% fewer cases of Parkinson's disease after 12 to 14 years.

Atoms form molecules which share electrons to maintain equal pairs. A polar free radical forms when the molecule splits leaving an atom with unpaired electrons. Radicals can have positive, negative or a neutral charge. Free radicals attack the nearest stable molecule, "stealing" its paired electron. When the "attacked" molecule loses its electron, it becomes a free radical itself, beginning a chain reaction (Antioxidants and Free). The chain reaction causes oxidative stress which then can progress in millions of cells causing damage or death to the cells. Polar antioxidants terminate these chain reactions by removing free radical intermediates. Antioxidants do this by being oxidized themselves, so antioxidants are often reducing agents. Antioxidants are very stable which allows them

to be able to donate an electron to a free radical to neutralize it and allow our bodies to excrete them safely and harmlessly (Kalash). For example, the most reactive free radical molecule is the hydroxyl radical. It can be made by X-rays or gamma rays splitting water molecules. The hydroxyl radical, written HO, is so reactive that it only takes one billionth of a second to react with neighbouring molecules, usually by stealing hydrogen atoms from other molecules. The hydroxyl radical regains the lost electron and forms a water molecule (H_2O). To regain its' electron pair, the hydroxyl radical has changed another molecule by removing a hydrogen electron from it. With antioxidants, the chain reaction does not keep repeating itself to cause a genetic mutation (Gieseg).

After concluding research, it has been proven antioxidants help the human body in many ways and research is still being conducted to fully understand how much antioxidants can affect the human body. Understanding the fundamentals of chemical bonds between antioxidants and free radicals can truly explain what happens between them. Using the concepts of chemical bonding, it is shown how the mechanism of antioxidants are used to eventually eradicate the free radicals that act as the source for different illnesses. The intake of antioxidants prevents and formation of the harmful free radicals, the treatment of antioxidants can be effective for illnesses.

Works Cited Page

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Work Sample Evaluation

Subject Area: Chemistry
Task Title: Atoms, Molecules, Bonding, and Beyond
Student Work Sample Title: Antioxidants and Their Effect on Free Radicals

The document was scored using the *CCR Task Bank Rubric*. The final scores are indicated in the following chart.

Scoring Criteria	Insufficient Evidence	Developing	Progressing	Accomplished	Exceeds
Research and Investigation				**X**	
Ideas and Content				**X**	
Reading and Analysis				**X**	
Communication				**X**	
Organization				**X**	
Accuracy			**X**		

Annotations: The following evidence from the work sample and the reviewer's comments support the scores above. Page and line numbers refer to the original work sample.

Scoring Criteria	Page #	Line #	Commentary about the work sample
Research and Investigation: *Locating resources independently and/or identifying information within provided texts*	4		The work sample cites numerous references. However, the student only consulted online printed materials.
	2	10	The use of information from scientific studies is evident through the presentation of Zhang's work with antioxidants.
Ideas and Content: *Presenting a thesis and understanding concepts*	1	7-9	"Studies have proven that antioxidants may be helpful in curing diseases or illnesses by using antioxidant treatments." This thesis gives the reader a clear understanding of where the text is headed in the explanation.
	1-3		The writer seems to have a good grasp of what is being discussed.
Reading and Analysis: *Evaluating sources and selecting evidence to support the central idea*	2	3-14	This paragraph is the epitome of using informational text from outside sources to present information and provide evidence to back up the information presented.
	1	12-20	Good discussion of oxidative stress.
Communication: *Using subject-appropriate language and considering audience*			The incorrect use of in-text citations is one of the few negative points of this paper.
	2	18	The student notes a use of informal language with quotation marks to set the wording apart from other sections of text. See "stealing" and "attacked."
Organization: *Structuring main ideas and supporting information*	3	10	There is a good transition at this point, mentioning that the student conducted research.
	1-3		The paper flows very well from topic to topic.
Accuracy: *Attending to detail, grammar, spelling, conventions, citations, and formatting*	1-3		There are some issues with in-text citations. Citing the title of articles ("Antioxidants and Free" nor "Antioxidants: Vitamin") is not standard practice.
	1-3		Grammar was not an issue when reading this work sample.