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Complete Vaporisation of a Human Body

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Abstract

From the previous paper, we were able to determine, hypothetically, the approximate amount of energy required to completely vaporise a human skeleton. In this paper, we focused on vaporising the whole water constituent of the body and the remaining tissues of a human body by finding the total dissociation energy for each of this constituent. For simplification, we used dried pork to represent the remaining tissues of the body. Finally, we calculated the combined amount of energy required to completely vaporise a human body to be 2.99GJ

Introduction

From our previous paper, 'Human Body Vaporisation', we mentioned that we would determine the dissociation energy required to vaporise the rest of the human body apart from the bones.

For simplification, we decided that we would divide the human body into the following content; bones (skeleton), water and the remaining soft tissues (with the absence of water). We were able to determine that the amount of energy required in dissociating the skeleton of a body of mass 78kg as 89.91×10^3kJ. In this paper, we now calculate for the water content of the human body, taking the amount of water to be 70% of the body. We will also calculate the rest of the tissues which would be taken as 15% of the body weight [1]. At the end of the paper, we will sum up the total dissociation energy obtained from the dissociation energies calculated in this paper and the previous paper. This would give us approximately the amount of energy required to completely vaporise a person.

Water Content of the Body

Water makes up an important constituent of the human body, having several crucial functions necessary for survival. It makes up about 70% of a young adult body.
Water molecules are symmetrical V-shaped molecules given by the molecular formula H_2O. It is therefore made up of two O – H bonds [2] .

Dissociation Energy of Water Content of Body

For an average young adult with a mass of 78kg and 70% water content, the total mass of water would be 56.4kg.
Thus, to determine the dissociation energy of this amount of water, the number of moles of the water would be determined using the molar mass of water and the mass of the water [3];

$$Molar\ Mass\ of\ H_2O = (\,H\ X\ 2\,) + (O\ X\ 1\,) = (1{,}00794\ X\ 2) + (15{,}9994) = 18{,}01528\ g\ mol^{-1} \approx 0.018\ kg\ mol^{-1}$$

The amount of H_2O in the body would then be;

$$No\ of\ moles = \frac{mass}{molar\ mass} = \frac{54{,}60kg}{0{,}018kg\ mol^{-1}} = 3.03 \times 10^3 moles$$

Given that;

1mol of H_2O → 2moles O – H bond

Therefore, $3.03 \times 10^3 moles$ of water would have $6.06 \times 10^3 moles$ of O – H bonds

Since the bond energy of one O – H bond is 460kJ;

$$Total\ Water\ dissociation\ energy;\quad \frac{(6.06 \times 10^3 moles) \times 460kJ}{1mol} = 2.79 \times 10^6 kJ$$

Rest of the Tissues

The last of our human body constituent is a complex mixture of muscle tissues, connective tissues, epidermal tissues and other organic materials with water included.

Since we have already calculated the energy of dissociation of the whole water content of the body, we would ignore the water part of these tissues and only calculate for the dry mass of the tissue mixture [4].

Assuming that the rest of these tissues are a combined 15% of the mass of the body of a human with mass 78kg, then the total mass of the rest of these tissues would be 11.7kg.

Due to the complexity of calculating the dissociation energy of each dry tissue and organic materials included, we would assume widely that the rest of the human tissue would be similar to dried pork. Thus we can calculate the calorific content of dried pork of 11.7kg and equate it to the dissociation energy of the rest of the tissues [5].

Pork has been chosen due to the similarities between human flesh and pig flesh. The anatomy of a pig is similar to that of human especially with regards to the skin and other tissues [6].

Dissociation Energy of the Rest of the Tissues

To find the dissociation energy of the rest of the tissues, we would use calorimetric values of 100g of dried pork which was given as 230kcal [7].

Therefore, the amount of calories for 11.7kg of pork would be;

$$= \frac{11700g \times 230kcal}{100g} = 26910\ kcal$$
$$= 1.13 \times 10^5\ kJ$$

Thus, we assume that the amount of energy required to completely vaporise the rest of the tissue is $1.13 \times 10^5\ kJ$.

Total Vaporisation Energy

We can now calculate the total energy required to fully vaporise a human body based on our assumptions from the past paper and this paper. This would be the sum of the vaporising energy of the bones, water content and the rest of the tissues of the human body;

$$Total\ Energy\ of\ Vaporisation;$$
$$= water\ content + rest\ of\ tissues + bones$$
$$= 2.79 \times 10^6 kJ + 1.13 \times 10^5 kJ + 89.91 \times 10^3 kJ$$
$$= 2.99 \times 10^6 kJ$$

Thus, the total amount of energy required for a complete vaporisation of a human body of mass 78kJ is approximately $2.99 \times 10^6 kJ$.

Conclusion

From analysing the individual dissociation energy of each of the main human body constituent we described, we have been able to determine the total amount of energy required to completely vaporise an adult person of 78kg. This was calculated to be 2.99×10^6kJ.

It is however important to realise that to achieve a complete instantaneous vaporisation of a person would require that the calculated energy of vaporisation is applied evenly in a short amount of time. Thus, vaporising a human completely would require a very high power input in practice.

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