Human Vapourisation

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Abstract
This paper aims to quantify the net heat energy required by an average human body for vapourising and also calculates the approximated entropy change for vapourisation.

Keywords
Specific Heat Capacity, Latent Heat of Vapourisation,Tissues, Fire Point, Enthalpy, Entropy

I. Introduction

Various Experiments have been performed by various scholars for determining the exact heat required to vapourise the body, this paper aims to take a step forward in that direction. The entropy change is also a very important parameter for determining the unorderness of a body so the unorderness of a vapourised body is quiet interesting to figure out. The calculation can be done by considering the body to be made of 3 parts, bonetissues, water and the rest amount of flesh.

II. Water Present in the Body

Assuming the average body mass of human to be 62 kg or 136.687 pound [1].We know that about 65% of humanbody is composed of water [2], so the mass of water in human gets to be 40.3 kg.
The average of Normal oral temperature of human = 37°C [3]
Specific heat capacity of water = 4.179 (KJ/(KgK)) [4]
Now according to [5, p 63]
Q 1= M*C*ΔT
Q1=40.3*4.179*63
Q1=10610.0631 KJ
ΔS1=Q/T
=34.20945 KJ/K
Latent heat of vapourisation of water = 2257 KJ/Kg [6]
Q2=M*L
Q 2= 90957.1 KJ
ΔS2=243.754 KJ/K
According to [p5 131-160] we can find the net entropy by adding the previous entropies.
Net heat required by water =(10610.063+90957.1)KJ
=101567.163 KJ
Net entropy change by heating water=ΔS1+ΔS2=277.963 KJ/K

III. For bone

Human body contains around 15-20% of mass in bones, and bons are composed of 10-20%water, 60-70% mineral usually Ca10(PO4)6(OH)2 known as Calcium Hydroxyapatite, and rest amount to a protein called collagen C2H5NOC5H9NOC5H10NO2 [7] Let us nowfind the enthalpy and entropy change for vapourising bone tissues, Accouding to [8] the melting point of bone ash is 1670°C and specific heat at around more than 400K is more than 2.50 kJ/kg [9] So heat required to melt the bone ash will be,
Q3=M'*C*ΔT
Here M'=20% of 65 kg i.e
=13kg
So, Q3=13*2.6*(1670-37)
=55195.4 kJ
And enropy change will be,
ΔS3=Q3/T=178.0496kJ/K
Now after getting melted, The bone ash consist of only 50% of its calcium oxide and rest phosphorus pentaoxide thking it's latent heat to be equal to that of calcium phosphate which is 545 kJ/kg [10]
So, heat gained by bone will be
Q4=M'*L
=13*545=7085 kJ
And entrop change will be ,
We know that [11] the boiling point of calcium oxide is 2850 °C.
S4=Q4/T=7085/2850.
=2.48596 Kj/K

IV. For Rest of Mass

Since the other body constituent are a complex mixture of muscle tissues, connective tissues, epidermal tissues and other organic materials along with bone tissues [12]. Neglecting bone tissues we can take the pork in place of human flesh due to similarity between the two. Assuming that the rest of these tissues are a combined 15% of the mass of the body of a human with mass 62kg, then the total mass of the rest of these tissues would be 9.3kg. According to [13] 100 gm of Handl Tyrol - Dry Cured Pork Loin contains 230 kcal of energy.
So, for 9.3kg mass ,energy equired is
9300g*230kcal/100g=21390kcal or 89495.76kJ
Q5=89495.76KJ
Assuming pork gets converted directly in gaseous form without liqiation.The flash point or fire point, the temperature at which smoke from burning fat can burst into flame is 316 ◦C [14]
ΔS5=Q5/583.15=151.9065KJ/K
The net heat needed to vapourise is Q1+Q2+Q3+ Q4+Q5 =10610.0631 KJ +90957.1 KJ +55195.4 +7085+89495.76KJ =253342.923 KJ
The net entropy change is S1+S2+S3+S4+S5=34.20945 KJ/K +243.754 KJ/K+178.049 Kj/K+2.485 +151.9065KJ/K=610.403 KJ/K

V. Conclusion

From analysing the basic human composition the heat energy to vapourise the human has to be at least 253342.923 KJ due to which the change in enropy would be at least 610.403 KJ/K. But It is also to note that certain assumptions are taken in this paper which may not get handy on the ground and also the time to provide such large amount of energy would needed to be incredibly low thus requiring more power than calculated.

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