Understanding Sustainability and Tribology

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Sustainability is necessary for survival of life, as we know it, on this planet. What is sustainability? For Human race to survive, there are two kinds of sustainability that need to be addressed. They are, 1) Physical (Material) Sustainability and 2) Mental Sustainability. The talk will cover Physical Sustainability and the role of tribology in achieving this sustainability. The talk will also touch upon an aspect of life that will lead to Mental Sustainability. For physical sustainability it is important that the raw material being extracted for use in a product does not get exhausted. To understand this better the material being extracted are classified into two categories 1) What is replenished by nature and 2) What cannot be replenished by nature. If the material used in a product is replenished by nature, it is essential that the rate of extraction of the material is lower than the rate at which the material is replenished by nature. Only such material that can be replenished by nature can be discarded back to nature at the end-of-life of the product (Open Cycle). If the material being used is not replenished by nature, the only way the cycle can be made sustainable is by ensuring that such materials are completely recycled (closed cycle). The other aspect of sustainability is regarding the discard. Given that only materials that can be replenished by nature can be discarded, care must be taken to ensure that the discard meets two criteria 1) It has to be non-toxic and 2) It has to be bio-degradable. If the discard is toxic, it need not be emphasized that it will lead to death of living organisms, including Humans. If the discard is not bio-degradable it will lead to accumulation of the discard and, at some point, become a problem. Such non-biodegradable discard could also lead to imbalance in nature. Tribological products are generally ones that are rarely recycled and are mostly discarded into nature. Cutting oils generally fall into this category. This makes it essential that cutting oils are completely non-toxic, which largely is not true. This talk will cover the efforts made at IISc in development of completely non-toxic cutting oils. The talk will also cover other tribological products and the efforts required to make them sustainable.