

Clearing the Air About "The Haze"

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Introduction

From the beginning of time, man has lived in a continuous state of interdependence with his environment. If the forces of nature are harnessed well, they are a source of great benefit to mankind, but when this balance is tipped, nature's backlash on man can be quite devastating.

In recent times, we have seen many vivid examples of the magnitude of the destructive forces of nature, ranging from massive floods caused by typhoons such as Katrina and Rita, the hundreds of thousands of lives lost by the powerful tsunami and the destruction of the environment by the raging forest fires in Spain and California.

Yet man has not learnt his lesson. Often greed, at times gross ignorance and more often than not, just indifference to the effects of his actions on the environment result in man upsetting his balance with the environment.

In Malaysia, since 1990, the haze has become a predictable annual occurrence, varying only in its severity and duration. The cause being beyond our control, we are unable to prevent it from happening. However, it is within our means to be ready to take the necessary steps to minimize the effects of the haze on the health of Malaysians.

In order to be able to give appropriate advice and to allay the anxiety of the general public, it is necessary to have a clear understanding about the various effects of haze on humans.

The Great London Fog of 1952 caused almost 4,000 deaths within a period of four days and this massive death toll due to an environmental catastrophe has

always been engrained in the minds of many doctors¹. In Dorona, Pennsylvania, USA, an episode of smog in 1948 caused only 20 deaths².

However, it must be clear that what happened during the Great London Fog was a unique combination of lethal factors which resulted in these deaths. It was an extremely cold winter, and Londoners burnt more coal and peat fires to keep warm and it was the build-up of the by-products of these fires within the closed homes, coupled with the still winter air, that resulted in these gases reaching toxic levels causing many fatalities.

The possibility of this happening in Malaysia during the haze is very unlikely because we live in a tropical environment where our doors and windows are open and the source of the haze is hundreds of miles away.

What is Haze?

Haze is composed of solid or particulate matter, gases and liquid droplets. Individually these particles are invisible to the naked eye but collectively they become visible, and as the humidity increases, these particles grow in size making the haze more dense.

In Malaysia during each episode of haze, the smoke and the suspended particulate materials from the forest fires are carried towards Malaysia by the inter-monsoon winds (Fig. 1 and Fig. 2). Large particles will be deposited closer to the site of origin and what reaches us are the small suspended particles which vary in size from about 5 to 20 microns in size.

As the winds vary in intensity and direction during the inter-monsoon period, the extent of the ASEAN region that can be blanketed by the haze can vary. In 1991, 1994 and 1997 we had very prolonged and severe episodes of haze and it spread as far north as Southern Thailand and as far east as the Philippines.

This article was accepted: 15 December 2005

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Particle Size and API

Haze is basically composed of particulate matter, gases and liquid droplets. The Air Pollution Index (API) is derived from a combination of these elements. Particles < 2.5 microns are termed as fine and those > 2.5 microns are termed coarse. Particles about 5 microns in size are of the optimal size to get into our alveolus, but it is those of size 10 microns which get lodged into our lower respiratory tract and cause significant respiratory illness^{3,4,5,6}.

Apart from the API, we also measure PM 10, which is a measure of particles that are 10 microns in size. There is a growing concern that particles of PM 5 size should also be measured because they are capable of reaching the alveolus. Based on currently available data, the API and its effects on health are as shown in the table below.

Haze and its Effects on Our Health

Over the years, there has been great concern about the immediate and long term effects of haze on humans. Numerous studies have shown that there are no long term effects to the health of healthy individuals who have been exposed to short durations of air pollution^{3,4,5,6}. However, there are some immediate effects which include conjunctivitis and upper respiratory tract infections⁸.

When sulphur dioxide and nitric oxide gases which are part of the haze come into contact with the mucus membranes of the upper respiratory tract or the conjunctiva, they are converted to mild acids – sulphuric and nitric acid. It is the local irritant effects of these acids that result in the significant rise in cases of conjunctivitis and URTI during the episodes of haze⁹.

Haze - The Malaysian Experience

Contrary to the popular misconceptions that there is a dramatic rise in acute cases of bronchial asthma, there is only a marginal rise in asthmatics who have worsening of their asthma. In a paper entitled "Does acid haze induce asthma?" which looked at the effects of haze in Malaysia during one of the worst episodes in 1991 when the country was enveloped by haze for 160 days, the study showed a significant rise in PM 10 ($p < 0.001$) (Fig 3), but no concomitant rise in cases of acute asthma ($p < 0.317$)¹⁰.

The study also showed no significant rise in acute asthma cases even with a time lag, or with the log of the titratable acidity of sulphuric acid¹⁰. These findings are consistent with what was noted by Aris et al in their paper, which showed that hydroxymethanesulphonic

acid (HMSA) does not produce bronchoconstriction in asthmatic individuals¹¹.

In another paper which looked at the effects of haze on the Malaysian population during the haze in 1997, "When the sky turned yellow: A Malaysian experience of haze and asthma", it was once again shown (Fig. 4) that there was no significant rise in acute episodes of asthma despite a very significant rise in the API¹².

It is evident that during episodes of haze in Malaysia, there is a small increase in the number of acute cases of asthma and the API, PM10. Ambient levels of sulphur dioxide or nitric oxide are also all significantly raised. However, the studies have shown that despite a significant rise in these parameters, there is no significant concomitant rise in acute asthma cases. These studies have also shown that during each of these severe episodes of asthma, well controlled asthmatics did not report any worsening of their asthma¹².

What Should We Do?

When the API is more than 200, there is a significant risk of normal individuals suffering the ill effects of the haze. This includes the rise in both the occurrence of conjunctivitis and upper respiratory tract infections. The simple way to reduce this is by advising people to stay indoors and drink lots of water and also frequently wash their faces, more so if they have been outdoors.

Those with underlying cardiovascular and chronic respiratory illness should ensure that they continue to take their medications as prescribed. If they have an action plan for episodes of deterioration, they should follow it. Otherwise if they experience any worsening of their symptoms they should seek immediate medical advice.

Masks - Should We Wear Them?

Based on our knowledge about the constituents of the haze and the size of the particles, using surgical masks is ineffective as it will not prevent the particles of 10 microns and less from entering our lungs. We need to wear appropriate mask which conform to the specifications of the 3M mask, model number 8,710, or of a similar quality. Masks which conform to these standards are effective (Fig. 5). There are also those which have activated carbon filters. These are the types of mask that should be recommended for people who are forced to work outdoors for extended periods, such as police personnel and workers with the local governments⁷.

Wearing the wrong mask will lead to a false sense of security and encourage those using them to be out in the haze for extended periods. These masks too have

to be changed otherwise they themselves could be a source of illness.

Table 1: API values; it effects on health and the precautions we should take

API value	Status	Effects on health %	Precautions %
51-100	Moderate	None	None
101-200	Unhealthy	Mild eye and URTI symptoms in the healthy	Elderly and patients with CVD and Respiratory illness should limit outdoor activity
201-300	Very unhealthy	Significant effects and reduced effort tolerance in those with heart and lung disease. Widespread eye and URTI symptoms in the healthy	Elderly and patients with CVD and Respiratory illness should remain indoors. General population should limit outdoor activities.
> 300	Hazardous	Significant aggravation of symptoms in the susceptible groups and decreased effort tolerance in the healthy	General population must limit outdoor activities.
> 400	Very hazardous	Healthy individuals will experience symptoms causing limitation of ADL.	ALL people should remain indoors and only carry out essential outdoor activity.

Adapted from; Jeyaindran S. Haze Question and Answers, Asthma Society of Malaysia. Handout, 1996⁷.

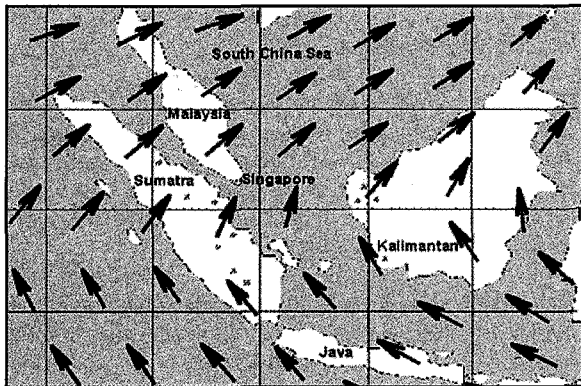


Fig 1: The wind directions over Malaysia during the inter-monsoon period

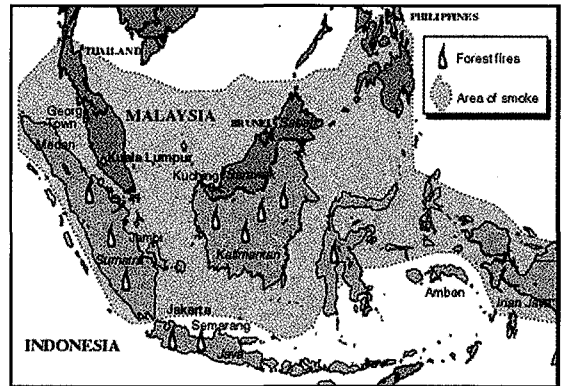
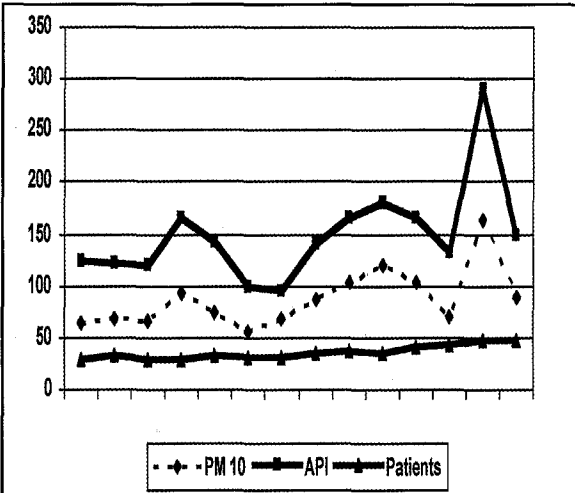
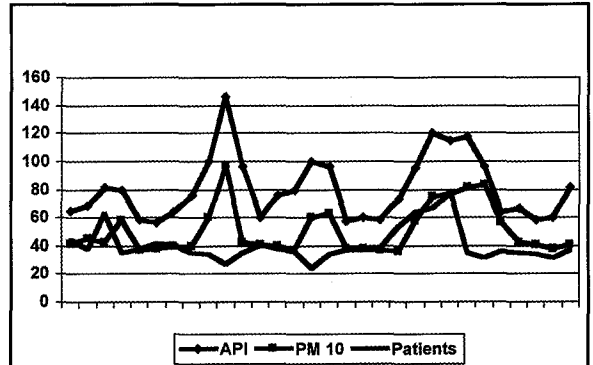


Fig 2: The extent of the haze due to the forest fires in Sumatra and Kalimantan



Adapted from: Jeyaindran S, Paul E. Does acid haze induce acute asthma – A Malaysian experience, *Eru Resp J* 1991; 4: 181-7.

Fig 3: The co-relation between the API, PM10 and the weekly mean number of patients with acute asthma during the haze in 1991.



Adapted from; Jeyaindran S. When the sky turned yellow: a Malaysian experience of haze and asthma. *The Asthma J*, 1998; 2: 76-9 12.

Fig 4: The lack of co-relationship between the API, PM10 and weekly mean number of patients with acute asthma during the haze in Malaysia in 1997



Fig 5: Photograph of policemen in Kuala Lumpur wearing the appropriate type of mask.

Discussion

Numerous studies on the effects of environmental pollution on man have shown that there are no long term ill effects to health when exposed for short periods of time¹³. In the short term however, it is evident that there are significant rises both in the

number of cases of conjunctivitis and upper respiratory tract infections but a non-significant rise in the number of acute cases of asthma^{5,7,9,10,13}.

When the haze becomes dense and we begin to feel oppressed, we fear the worst and there is often a sense of impending doom. However, there is very little clinical evidence that this will occur. To most, the haze is often nothing more than a nuisance causing us to suffer from sore eyes and throats.

Those with underlying cardiovascular and respiratory illness are more vulnerable to the acute effects of the haze and must take it upon themselves to ensure that they take their medication regularly and seek immediate medical aid if there is any worsening of symptoms.

Depending on the API reading we must offer advice particularly to those whose job demands that they spend long hours outdoors. They must be advised to also use the appropriate type of mask.

From time to time, the Malaysian government has had ministerial level discussions with our neighbors on how

to minimize the occurrence of haze by curtailing open burning and we have sent our fire fighters to help combat the haze. When necessary and with adequate prevailing weather conditions, we have resorted to cloud seeding to induce rain so as to reduce the API to healthy levels.

Medical practitioners, based on current scientific evidence, must give proper advice about the haze and its effects on the health of Malaysians. With this background knowledge, we should be in a better position to "clear the air about haze".

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