

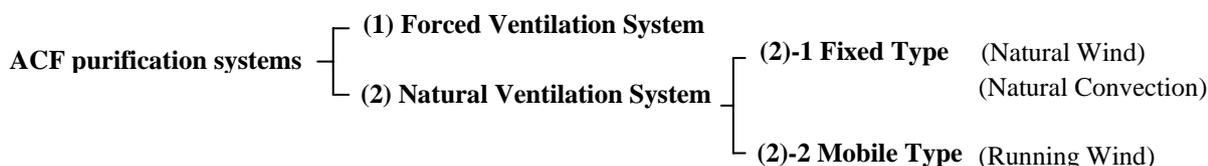
Characteristics of Activated Carbon Fiber on NO_x Purification and Concept of Wide-area NO_x Purification Technology

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(1) Introduction

In recent years, high concentration of NO_x and SPM in areas such as heavy traffic intersections (in dense residential areas) and over-lapping express ways (where the exhaust from cars tends to accumulate) is becoming a problem. In order to solve this problem, technology to purify the air from this kind of pollution needs to be established as soon as possible, along with efforts to reduce traffic and to build structures that limit the accumulation of pollution. The Fukuoka Institute of Health and Environmental Sciences has been endeavoring to develop air purification technology using ACF.

There are two air purification systems that we can present. (1) the forced ventilation system, and (2) the natural ventilation system. With the former, polluted air is directed into the ACF through a pump. Although it requires electric energy, a compact design can be made available for this equipment to purify the air of NO_x and SPM simultaneously. With the latter, the ACF can be mounted on roadside fences, installed in the walls of express ways ((2)-1: fixed type), or installed in the vehicle's front body ((2)-2: mobile type). The driving force of these equipments is natural wind and thus, they require neither electric energy nor maintenance, and equipment cost is minimized, making wide-area NO_x purification possible.



The ACF (activated carbon fiber) unit that the author et al. developed uses a natural wind as driving force to get the capacity of purifying air contaminants (NO_x as a main element) in the wide area without electric energy. Various applications with this type of unit are being examined for the installation of that as a fence along the road or as a front surface of dust collector. This unit must be designed and created as one of thin layers because its installation space is limited.

In addition, this unit needs a high efficiency ventilation, low-cost construction and simple maintenance with easy regeneration. We manufactured the ACF units and observed the NO_x scavenging ability of units in a field.

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(2) Experimental demonstration

(2)-1. Fixed point type

This technique uses natural wind to purify NO_x with the ACF unit installed on a part of the existing fences along the road and the sound insulating walls of expressway. As shown in Photo . 1 and Fig. 1 with a detailed example of “fixed point type”, we can examine the purification method using natural wind with the fiber-shaped or plate-shaped slit structured ACF mounted on the existing fences of urban road where there is much traffic or on the side and upper walls of tunnel road (i.e. T. Shimohara et al., 2008).

As a demonstration conducted by us in outdoor, at natural wind velocities of 1-2 m/sec, the NO and NO₂ purification rates were 5-30% and 80-95%, respectively. Furthermore, as for the used ACF unit, the nitric acid of 60% - 70% remaining in the ACF unit could be removed repeatedly by the simple water spray and washing. From these results, we expect “on-site regeneration” to rinse ACF with rain for the ACF unit installed along the actual road.



Photo. 1 Demonstration test at Hakata-ku, Fukuoka City (north region in Kyushu Island of Japan)

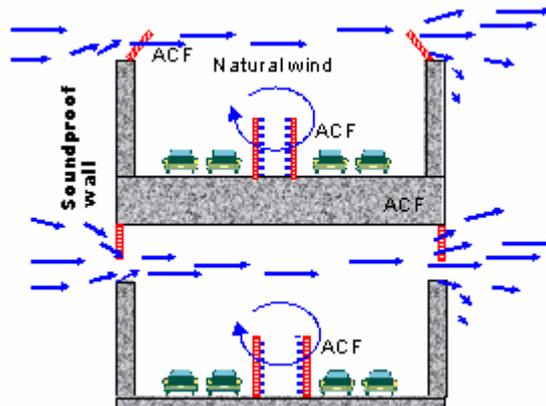


Fig. 1 Application of natural wind as a fixed purification material along road (Cross section of overlapping express way)

(2)-2. Vehicle running type

We installed the ACF-unit in the vehicle’s front body, the vehicle running wind is used as the driving power. When vehicles was moving on the road, about 50 % of NOx on the road was cleaned up by passing through the unit. Photo 2 shows the appearance of test vehicle. It is proven that this purifying system has the non-electric-energy, low-cost and maintenance-free features and can efficiently purify the high-concentration contaminated gas exhausted from the vehicles.

Fig. 2 shows that the vehicle running wind is going to purify air in the wide area. High concentration of NOx on thr roads of wide area can be purified like a vacuum sweeper by the vehicle running wind. The high effect of reducing them will be obtained in the wide area if this system can be installed on even 10% of all vehicles.



Photo. 2 ACF purification system installed in vehicle



Fig. 2 Image of air purification on road by ACF-unit mounted vehicle

Reference: T. Shimohara, S. Niiya, M.Yoshikawa, T. Kitada and I. Mochida, Proceedings of 15th Seminar of JSPS-MOE Core University Program on Urban Environment, p219~228. (Toyohashi city, Japan) 1-3 November (2008)