84-155

Freudenberg

January 25, 1988

Mr. Murray Cohen, Acting Director
Division of Safety Research
NIOSH 944
Chestnut Ridge Road
Morgantown, West Virginia 26505

Reference: New Proposed NIOSH Standard 42 CFR Part 84

Dear Mr. Cohen:

Attached is a copy of the presentation which Freudenberg Nonwovens will make at the NIOSH public hearing in Washington, D.C. on Wednesday, January 27, 1988. This document registers our objections to specific sections of the proposed NIOSH Standard 42 CFR Part 84.

We ask that NIOSH review our proposed changes to the Standard with the view to adopt these modifications before the Standard is finalized.

Thank you very much for your considerations.

Sincerely,

Chester J. Petkiewicz
Director Research & Development

CJP:hk

Attachments

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FREUDENBERG NONWOVENS

OBJECTION TO THE NEW PROPOSED

NIOSH STANDARD 42 CFE PART 84

DATED AUGUST 27, 1987

JANUARY 18, 1988

THE NEWLY PROPOSED NIOSH STANDARD PUBLISHED IN THE FEDERAL REGISTER ON AUGUST 27, 1987 CONTAINS SOME POINTS WHICH PRECLUDE A CLEAR, OBJECTIVE AND PRACTICAL JUDGEMENT OF RESPIRATOR FILTERS. OUR OBJECTIONS TO THIS NEW PROPOSED STANDARD ARE LISTED IN FIGURE 1. THE FOLLOWING TEXT ELUCIDATES OUR SPECIFIC OBJECTIONS TO THE PROPOSED STANDARD AND SERVES TO SUBSTANTIATE OUR CAUSE FOR CONCERN.

No. 1 OBJECTION TO USE OF SOLID AND LIQUID AEROSOLS FOR TESTING.

TESTING OF RESPIRATORS AGAINST BOTH LIQUID AND SOLID PARTICLES IS NOT NECESSARY.

IT IS OUR OPINION THAT IT IS SUFFICIENT FOR A RESPIRATOR TO MEET THE REQUIRED SPECIFICATIONS AGAINST SOLID OR LIQUID PARTICLES, BUT NOT BOTH SOLID AND LIQUID PARTICLES. THE SPECIFIC END USE REQUIREMENTS WOULD DETERMINE WHETHER THE RESPIRATOR WOULD HAVE TO PROVIDE PROTECTION AGAINST SOLID OR LIQUID AEROSOLS.

THE WELL KNOWN CLASS OF "ELECTRET" FILTERS ARE MADE WITH ELECTRICALLY CHARGED SYNTHETIC FIBERS. THIS CLASS OF FILTERS OFFERS THE DUAL ADVANTAGES OF HIGH FILTRATION EFFICIENCY AT RELATIVELY LOW BREATHING RESISTANCE. DEPENDING UPON THE "ELECTRET" FILTER STRUCTURE, THE "ELECTRET" FILTER WOULD CAUSE THE RESPIRATOR TO FILTER SOLID AND LIQUID PARTICLES IN A DIFFERENT WAY. THE REQUIREMENTS TO FILTER SOLID AND LIQUID AEROSOLS IS NOT NECESSARY AND SERVES ONLY TO INCREASE THE BREATHING RESISTANCE OF THE FILTER WITHOUT SERVING ANY OTHER USEFUL FUNCTION. AN EXAMPLE IS THE REQUIREMENT FOR HIGH EFFICIENCY AGAINST LIQUID AEROSOLS WHEN THE RESPIRATOR IS TO BE USED AGAINST SOLID PARTICLES. IN ADDITION, THE ADDED DISCOMFORT TO EASY BREATHING IS DONE TO THE END USER AT A HIGHER COST.

WE FEEL THAT THE RESPIRATOR SHOULD PROVIDE THE PROTECTION WHICH IS REQUIRED. BUT AT THE SAME TIME NOT INCREASE BREATHING RESISTANCE AND COST WITHOUT ANY ADDED BENEFIT TO THE USER.

WE RECOMMEND THAT TWO DIFFERENT CLASSES BE ESTABLISHED ACCORDING TO THE END USE REQUIREMENTS:

1. ONE FOR PROTECTION AGAINST SOLID AEROSOLS
2. ONE FOR PROTECTION AGAINST LIQUID AEROSOLS.

THE CHEMICAL NATURE OF THE AEROSOLS WHICH SHALL BE USED IS NOT SPECIFIED IN THE PROPOSED STANDARD. IT IS KNOWN THAT SOLID PARTICLES WITH EQUIVALENT PARTICLE SIZE BUT DIFFERENT CHEMICAL COMPOSITION, WILL PENETRATE IDENTICAL FILTERS AT DIFFERENT LEVELS DUE TO THE DIFFERENCES IN ADHESIVE FORCES.

FIGURE 2 IS ONE EXAMPLE OF THE DIFFERENCE IN PARTICLE PENETRATION FOR SOLID PARTICLES OF DIFFERENT COMPOSITION, BUT TESTED UNDER IDENTICAL CONDITIONS. THE EFFICIENCY AGAINST QUARTZ DUST PARTICLES IS HIGHER FOR ALL PARTICLE SIZES THAN THE EFFICIENCY AGAINST SMOOTH LATEX PARTICLES. FOR TEST PURPOSES, THE CHEMICAL NATURE OF THE AEROSOLS SHOULD BE SPECIFIED EVEN WHEN THE DIFFERENCE IN EFFICIENCY AGAINST DIFFERENT SOLID AEROSOLS IS RELATIVELY LOW.

IN ADDITION, ONLY THOSE AEROSOLS SHOULD BE CHOSEN FOR TESTING PURPOSES WHICH DO NOT ATTACK THE FILTER MEDIA. THE AEROSOLS SHOULD NOT ATTACK THE FILTER CHEMICALLY OR PHYSICALLY, NOR SHOULD THE AEROSOL NEUTRALIZE THE BENEFICIAL ELECTRIC CHARGES OF "ELECTRETS".

WE WERE INFORMED THAT NIOSH IS CONSIDERING USING AS TEST AEROSOLS:

$NaCl$ - AS SOLID PARTICLES

DOP - AS LIQUID OIL PARTICLES.

SODIUM CHLORIDE HAS PROVEN TO BE A SUITABLE SOLID TEST AEROSOL FOR ALL FILTER MEDIA AVAILABLE IN THE MARKET. IT IS IN USE TODAY IN MANY STANDARD TEST PROCEDURES (E.G., BRITISH, GERMAN AND EUROPEAN STANDARDS). WE CONSIDER N_ACL, THEREFORE, TO BE AN ACCEPTABLE TEST AEROSOL FOR DETERMINING THE FILTER EFFICIENCY AGAINST SOLID PARTICLES.

WE STRONGLY RECOMMEND, HOWEVER, THAT DOP NOT BE USED AS A LIQUID OIL TEST AEROSOL BECAUSE OF ITS DIFFERENT EFFECTS ON THE FILTER MATERIALS AVAILABLE IN THE MARKET. DOP DOES NOT HAVE ANY NEGATIVE EFFECT WHEN USED FOR TESTING PURE MECHANICAL FILTERS; E.G., GLASS FIBER FILTERS. IT IS KNOW, HOWEVER, THAT DOP NEUTRALIZES THE ELECTROSTATIC CHARGES OF "ELECTRET" FIBERS IN A VERY SHORT TIME. THIS NEUTRALIZATION OF ELECTRIC CHARGES CAUSES A REDUCTION IN FILTER EFFICIENCY, NEGATING A MAJOR BENEFIT OF "ELECTRET" FILTERS. PLEASE SEE FIGURES 3, 4 AND 5 FOR SUPPORTING DATA PUBLISHED BY THE INTERNATIONAL SCIENTIFIC COMMUNITY IN THE UNITED STATES, JAPAN AND GERMANY.

IT CAN READILY BE SHOWN THAT THE NEUTRALIZATION EFFECT IS NOT CAUSED BY ALL LIQUID (OIL) AEROSOLS. SOME RESULTS ARE SHOWN IN FIGURE 6 FOR SOME OF OUR "ELECTRET" FILTER MEDIA. TWO SAMPLES OF THE SAME MATERIAL WERE CHALLENGED SEPARATELY WITH DOP AND WITH PARAFFIN OIL AEROSOLS. BOTH AEROSOLS HAD A COMPARABLE MASS CONCENTRATION. AIR FLOW AND ALL OTHER TEST CONDITIONS WERE IDENTICAL. THE PARTICLE DIAMETER OF THE MONODISPERSE DOP AEROSOL WAS $D = 0.3$ UM, WHILE THE DIAMETER OF THE MONODISPERSE PARAFFIN OIL WAS $D = 0.4$ UM. WE DO NOT BELIEVE THAT THIS DIFFERENCE IS SIGNIFICANT.

FIGURE 6 SHOWS THAT THE INITIAL PENETRATION VALUES WERE NEARLY THE SAME FOR THE TWO TEST AEROSOLS. THE DATA ALSO SHOWS THAT THERE ARE LARGE DIFFERENCES BETWEEN THE TWO AEROSOLS AS A FUNCTION OF TIME DEPENDENT LOADING. THE PENETRATION OF THE PARAFFIN OIL AEROSOL INCREASES ONLY SLIGHTLY WITH TIME, DUE TO THE SLIGHT WETTING OF THE FIBERS. WHEN CHALLENGED WITH DOP, HOWEVER, THERE IS A STRONG INCREASE IN PENETRATION FROM THE START OF TESTING. THIS PENETRATION INCREASES RAPIDLY UP TO APPROXIMATELY 100 TIMES THE INITIAL VALUE. THESE DATA CLEARLY SHOW THAT THE ELECTROSTATIC CHARGES OF AN "ELECTRET" FILTER ARE DESTROYED BY DOP AEROSOLS.

ALL OF THE ABOVE EXAMPLES CLEARLY DEMONSTATE THAT DOP IS NOT SUITABLE AS A TEST AEROSOL. AS AN ALTERNATIVE TO DOP WE SUGGEST PARAFFIN OIL. PARAFFIN OIL IS ALREADY USED AS A TEST AEROSOL IN THE GERMAN AND CEN STANDARDS, AND IS CONSIDERED TO BE SUITABLE FOR ALL FILTER MEDIA AVAILABLE ON THE MARKET.

No. 2 OBJECTION TO USE OF TWO AIR FLOW RATES FOR TESTING.

BOTH PENETRATION AND PRESSURE DROP ARE DEPENDENT UPON THE CORRESPONDING AIR FLOW RATE. THEREFORE, IT IS POSSIBLE THAT A RESPIRATOR WILL PASS THE REQUIREMENTS OF THE STANDARD AT ONE FLOW RATE, AND FAIL AT A SECOND FLOW RATE. IN ORDER TO AVOID SUCH SITUATIONS, WE RECOMMEND THAT THE STANDARD SPECIFY ONLY ONE FLOW RATE FOR DETERMINING THE PENETRATION AND AIR FLOW RESISTANCE VALUES. SPECIFICATION OF ONE FLOW RATE WOULD ALLOW FOR A CLEAR CLASSIFICATION OF FILTER MEDIA.

No. 3 OBJECTION TO THE PROPOSED TEST LIMIT PENETRATION VALUES.

AS WE HAVE PREVIOUSLY STATED, "ELECTRET" FILTER MEDIA ARE APPROVED AND USED IN THE MARKET FOR RESPIRATORS. WE HAVE ALSO PREVIOUSLY STATED THAT "ELECTRET" FILTERS OFFER THE DUAL ADVANTAGE OF HIGH EFFICIENCY AND LOW AIR FLOW RESISTANCE. WHEN SUCH "ELECTRET" FILTERS ARE CONTINUOUSLY LOADED WITH LIQUID OIL AEROSOLS A SLIGHT BUT CONSTANT INCREASE IN PENETRATION RESULTS WITH AN INCREASE OF AEROSOL LOADING. THIS BEHAVIOR ASSUMES THAT NO SIGNIFICANT DUST CAKE WILL BE FORMED ON THE FILTER MEDIAL DURING THE CHALLENGE WITH LIQUID OIL PARTICLES. AN EXAMPLE OF THIS EFFECT CAN BE SEEN IN FIGURE 6 WHERE AN "ELECTRET" FILTER IS LOADED WITH PARAFFIN OIL MIST. IT IS UNREALISTIC, THEREFORE, TO EXPECT THAT THE PENETRATION OF AN "ELECTRET" FILTER REMAINS CONSTANT WHEN THE CHALLENGE POINT IS REACHED.

BY THE APPROPRIATE CONSTRUCTION OF A FILTER MEDIA IT IS POSSIBLE, HOWEVER, TO OBTAIN PENETRATION VALUES OF A RESPIRATOR WHICH WILL BE BELOW THE REQUIRED TOLERANCE LIMITS DURING THE TOTAL RECOMMENDED USAGE TIME. THIS WOULD OCCUR REGARDLESS OF THE SLIGHT BUT CONSTANT INCREASE OF PENETRATION WITH INCREASED AEROSOL LOADING.

WE RECOMMEND, THEREFORE, THAT THE PROPOSED STANDARD REQUIRE THAT THE PENETRATION AT A GIVEN LOADING VALUE (E.G., 100 MG ± 5 MG BE USED.

FIG. 1 POINTS OF OBJECTION TO THE NEWLY PROPOSED NIOSH STANDARD, DATED AUGUST 27, 1987.

1) SUBPART V SECTION 84.273

"FILTERS OF PARTICULATE RESPIRATORS SHALL BE TESTED FOR INSTANTEOUS PENETRATION FILTER EFFICIENCY AGAINST BOTH SOLID AND OIL LIQUID PARTICLES IN THE FOLLOWING MANNER"

2) SUBPART V SECTION 84.273 (D)

"FILTER SHALL BE TESTED, EACH AT A CONTINUOUS AIRFLOW RATE OF 32 AND 85 LITERS PER MINUTE."

3) SUBPART V SECTION 84.273 (H)

"IF FILTER PENETRATION IS INCREASING WHEN THE 100 ± 5 MG CHALLENGE POINT IS REACHED, THE TEST SHALL BE CONTINUED UNTIL THERE IS NO FURTHER INCREASE IN PENETRATION."

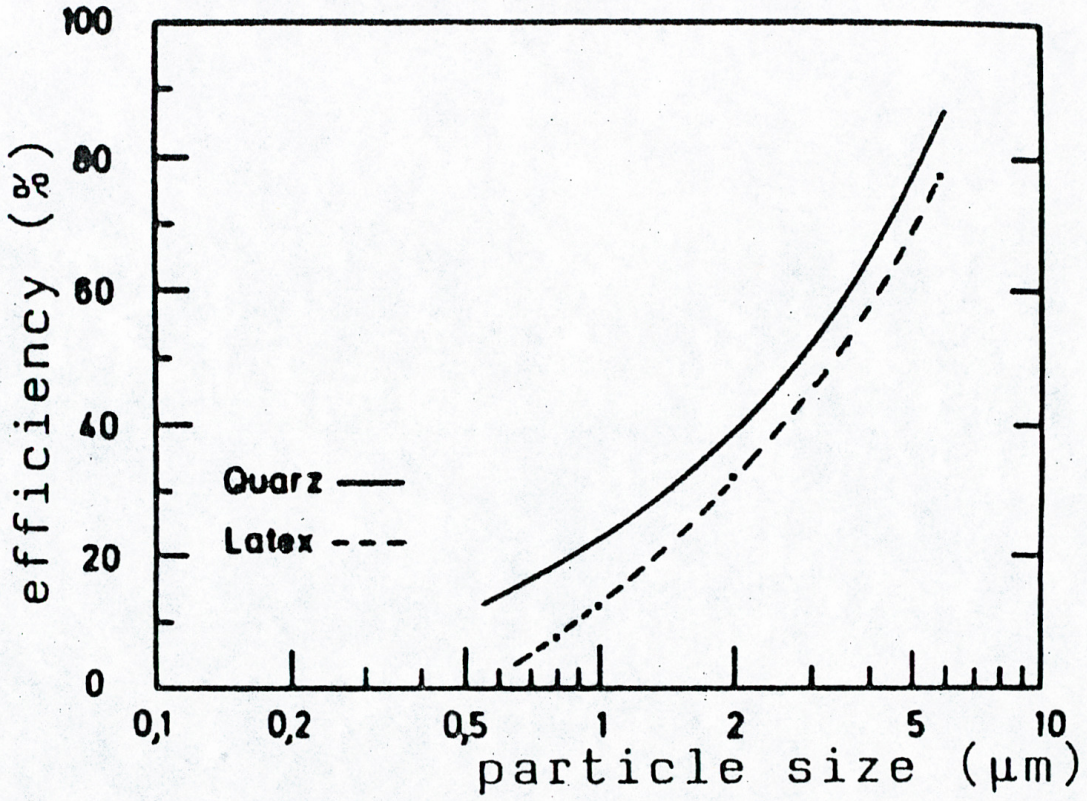

FIG. 2 FILTRATION EFFICIENCIES OF TWO SOLID AEROSOLS UNDER THE SAME TEST CONDITIONS (JODEIT, FORTSCHR, BER. VDI REIHE 3, NR. 108 (1985)).

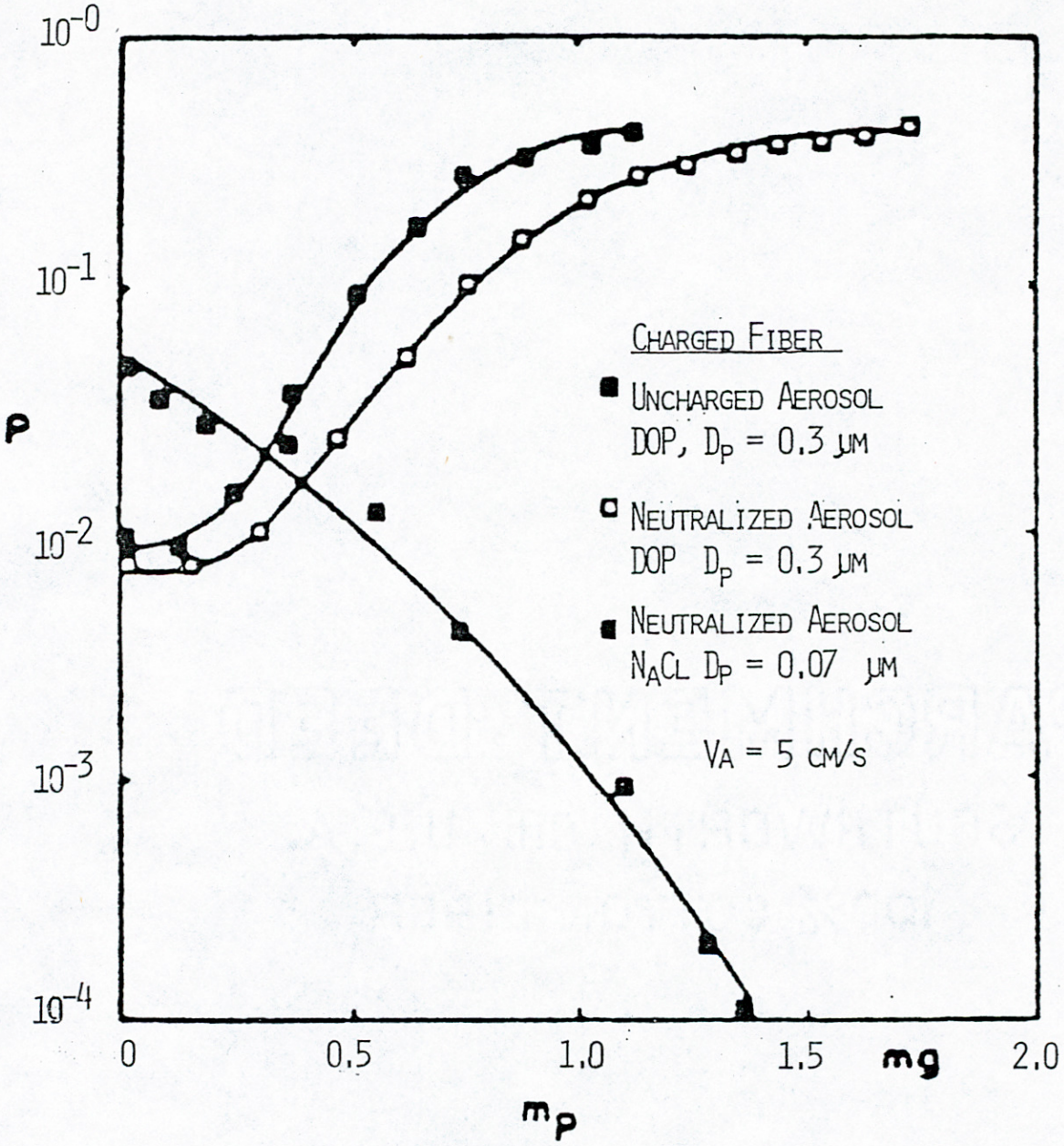

FIG. 3 PENETRATION OF AN ELECTRET FILTER AS A FUNCTION OF MASS LOADING OF LIQUID AND SOLID PARTICLES (FISSAN, NEUMANN IN AEROSOLS / LIU, PUI, FISSAN; ELSEVIER (1984)).

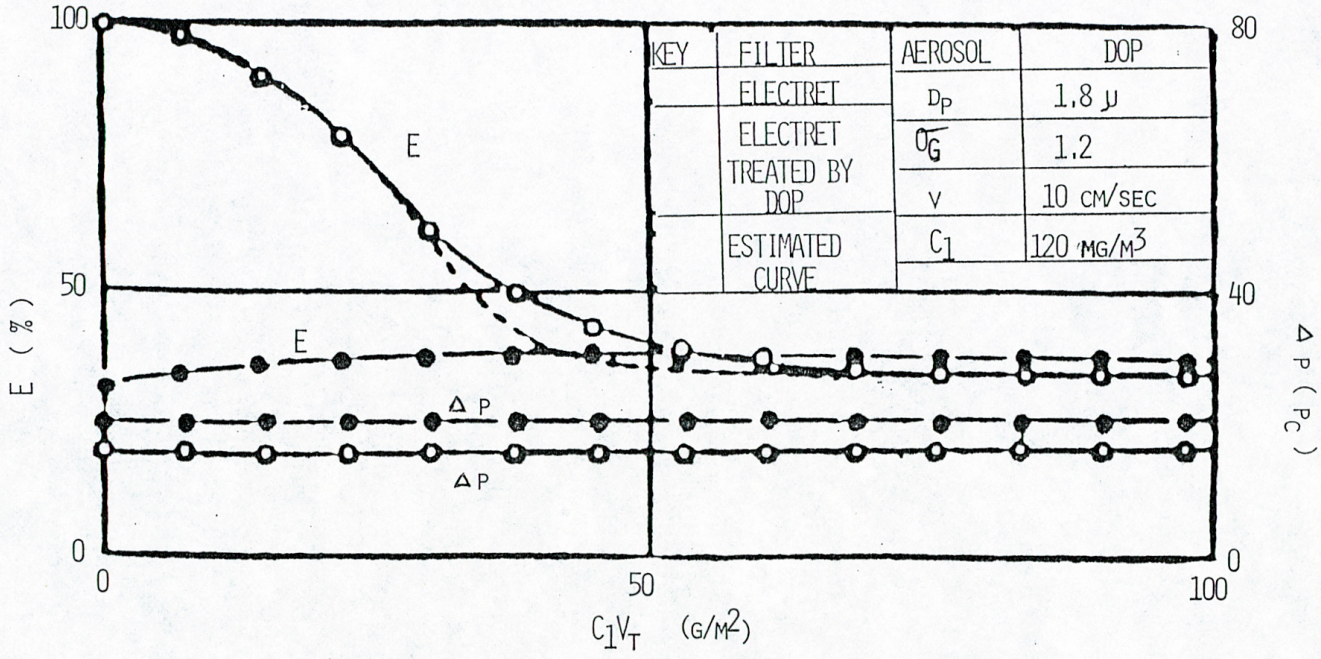

FIG. 4 TIME DEPENDENCY OF COLLECTION EFFICIENCY OF AN ELECTRET FILTER, WHEN LIQUID DOP PARTICLES FILTERED (KANAOKA, EMI AND ISHIGURO IN AEROSOLS / LIU, PUI, FISSAN: ELSEVIER (1984)).

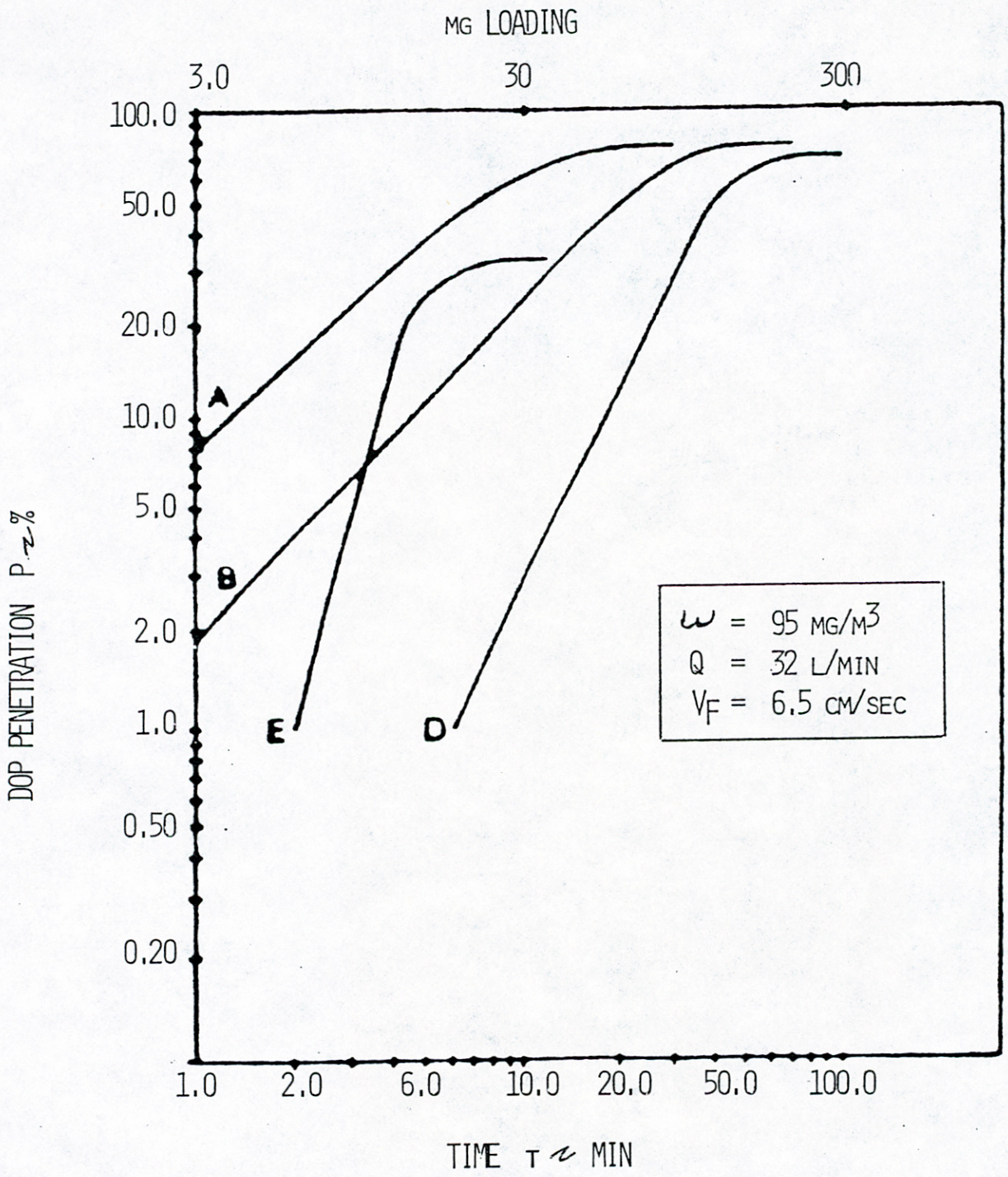

FIG. 5 DEGRADATION OF DIFFERENT ELECTRET FILTERS DUE TO DOP LOADING, (ACKLEY IN WORLD FILTRATION CONGRESS III PROCEEDING: FILTRATION SOCIETY (1984)).

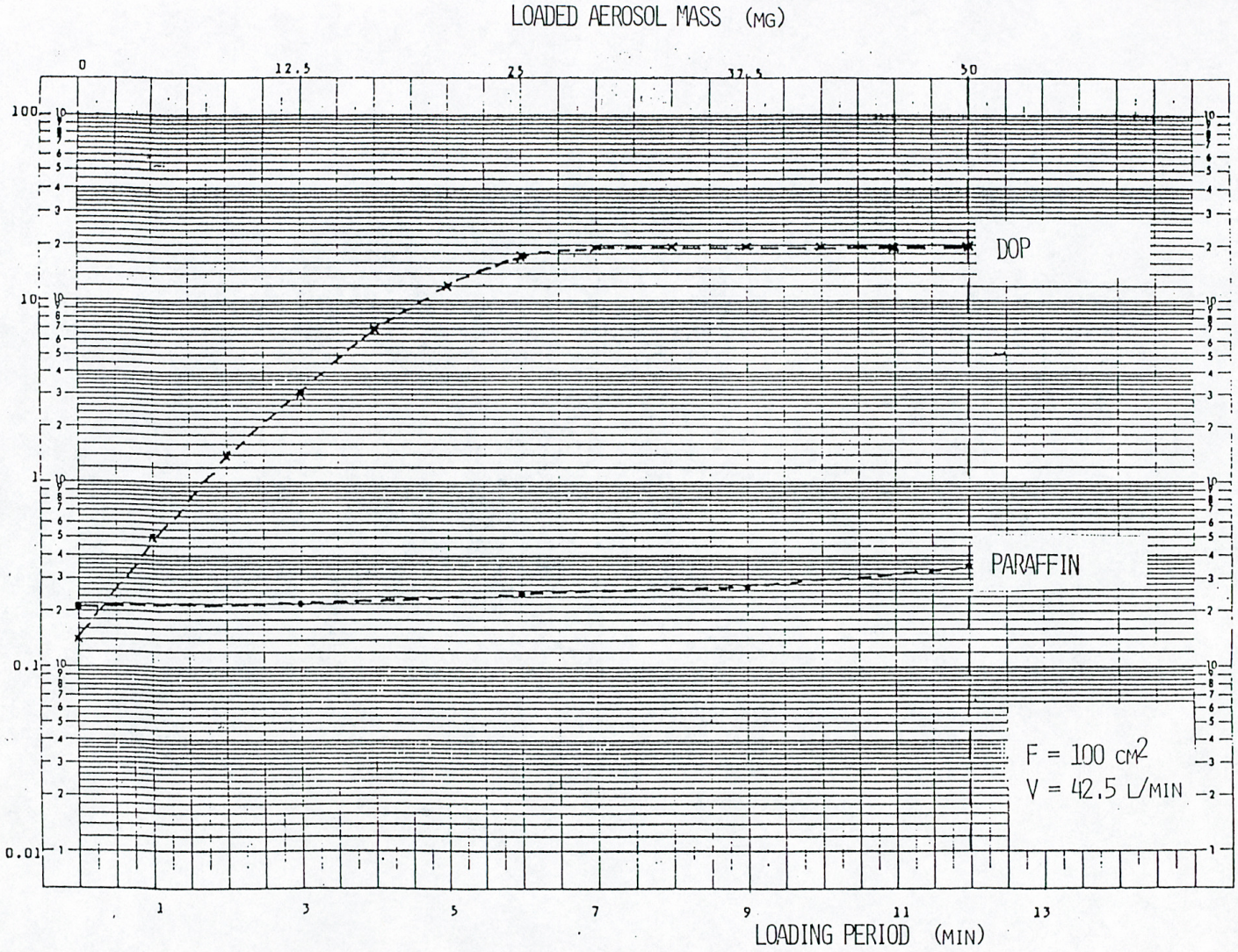

FIG. 6 TIME DEPENDENCY OF PENETRATION OF AN ELECTRET FILTER WHEN LOADED WITH LIQUID DOP AND PARAFFIN OIL PARTICLES