

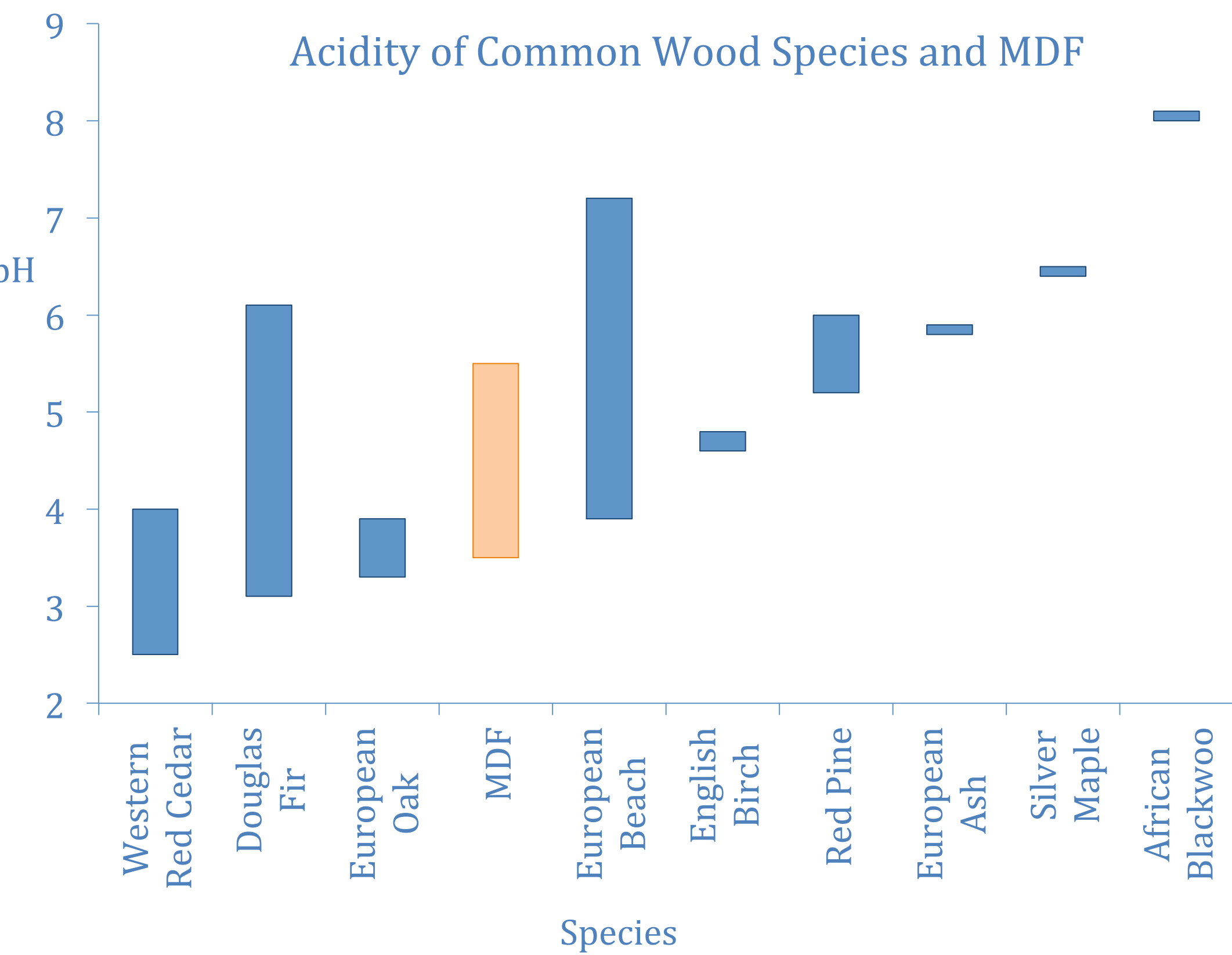
Testing the Sealing of Medium Density Fiberboard (MDF) to Prevent Corrosive Emissions

Rachel Greenberg, MA, MSc



MDF in Museum Display Cases

The suitability of a material for use in a museum display case is commonly determined using an accelerated corrosion test, or Oddy Test, to screen materials for the emission of harmful pollutant gasses. Wood products, such as medium density fiberboard (MDF), are commonly used for their pragmatic and cost effective qualities. However, wood products emit corrosive gasses that cause significant deterioration of objects, and are therefore unable to pass an Oddy Test. If the use of wood products in display cases is unavoidable, they must be sealed with a surface barrier to limit the emission of VOCs into the environment. A range of surface barriers is available, but some can release VOCs themselves and others do not fully prevent emissions.

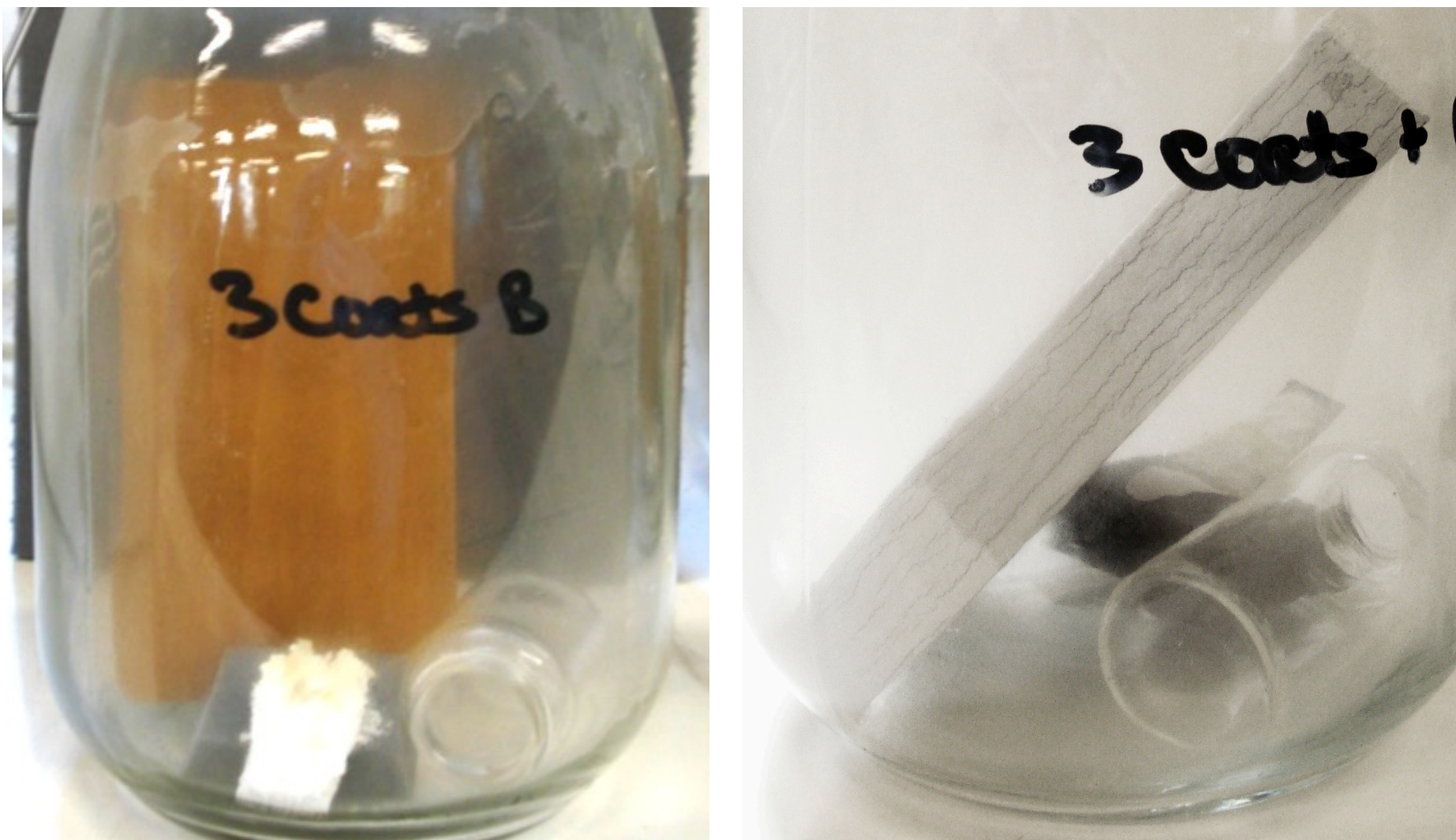


Sealing MDF

Manufactured films, such as Marvelseal, have been proven to fully prevent corrosive emissions, but liquid coatings are often preferred for their ease of application. In a test comparing liquid sealants, Dacrylate acrylic glaze performed the best of those still available. However, Dacrylate performed very poorly compared to the manufactured films and therefore further testing was required to improve the method of application and sealing efficiency.

Accelerated Corrosion Testing

An Oddy Test was devised to analyze the number of coats of Dacrylate required to reduce VOC emissions combined with the best-case scenario for application and drying. MDF blocks were sealed with one, two, and three coats of Dacrylate and given twenty-four hours drying time in between coats and four weeks to dry after the final coat. The tests were assembled in one liter Kilner jars with 6ml of distilled water and a lead coupon (the metal most sensitive to the VOCs emitted from wood).



Corroded lead coupons caused by VOCs emitted from the swollen MDF exposing fresh wood particles

Results

After only seven days, all the tests showed at least the first signs of corrosion and by nine days were fully corroded. The test jar containing MDF sealed with Dacrylate and a layer of paint proved to indicate swelling of the MDF. The paint remained intact along the compact manufactured surfaces, but cracked along the cut edges, indicating that the MDF had absorbed water and swelled to expose fresh and unsealed wood particles. Water accelerates the degradation of MDF, producing higher amounts of organic acids. Once fresh MDF is exposed to the test environment, the sealing efficiency of the Dacrylate can no longer be effectively analyzed.

In a typical Oddy Test, these results would be considered a fail and the material in question would not be used with museum objects. However, a typical test only analyzes the suitability of a single material and not how a known suitable material is able to control a known problematic material.

Accelerated Corrosion Test Results

Sealed MDF Sample	Corroded After (days)	Corrosion Ranking	Corrosion Factor
Control	-	0	0.0
Unsealed MDF	7	4	3
1 Coat Dacrylate	A 6, B 7, C 7	4, 4, 4	3.1, 3, 3
2 Coats Dacrylate	A 7, B 6, C 5	4, 4, 4	3, 3.1, 3.3
3 Coats Dacrylate	A 6, B 5, C 7, + paint 7	4, 4, 4, 4	3.1, 3.3, 3, 3
Marvelseal	A -, B -, C -	0, 0, 0	0.0, 0.0, 0.0

Corrosion Ranking: 0 (No Corrosion) to 4 (Extensive Corrosion)
Corrosion Factor = [CR (28 days-n)]/28 days
CR = Final Corrosion Ranking, n = number of days for corrosion to have formed

Discussion

The results of the Dacrylate sealed MDF differed greatly from that of the Marvelseal wrapped MDF. Marvelseal passed the twenty-eight day cycle without causing corrosion of the lead coupons. Such different results in the two types of sealing materials make the tests difficult to compare. This suggests that Oddy Testing using high heat and humidity is not an acceptable method for examining MDF sealed with liquid coatings.

Conclusion

Assessing the sealed MDF with realistic conditions using ambient temperature tests or with other analytical methods may enhance the comprehension of sealing properties, limiting the necessity to utilize accelerated corrosion testing on this type of material altogether.