

SUSTAINABLE CHEMISTRY CATALYST

Collaborative Innovation Forum Functional Substitutes to 6PPD in Tires

University of Massachusetts Lowell
Lowell Center for Sustainable Production
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www.uml.edu | www.sustainableproduction.org

Highline College Des Moines, WA
Dec. 14, 2022

IP Landscape review

Miles Dearth, Esq.

Search Approaches

Tools: Google Patent
PatBase®

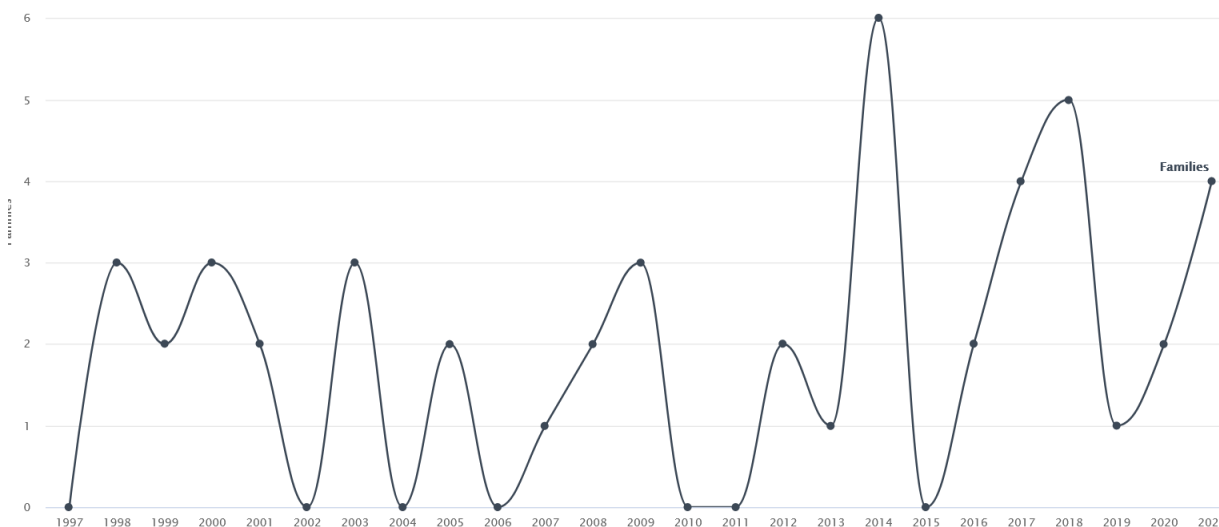
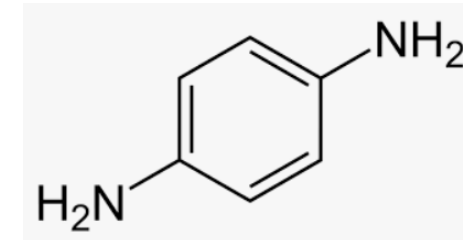


- By Keywords
- Contextual — large block of text
- cross w/ Assignees
- cross w/ classification
- cross w/ inventor (author)
 - Literature-to-patents
- By chemical fragment (ACS SciFinder®)
- Text and Data Mining (ACS)

Top- Down Keywords

p-phenylenediamine and tire

116 families



Goodyear Co. (28)

Bridgestone Corp. (20)

Firestone Tire And Rubber Co. (16)

Toyo Tire And Rubber Co. Ltd. (8)

Hankook Tire Co. Ltd. (6)

Triangle Tire Co. Ltd. (6)

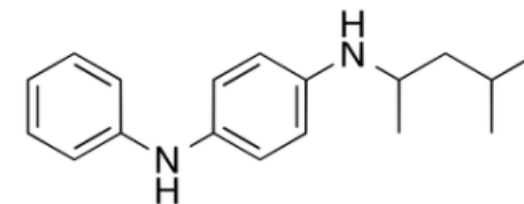
Hankook Tire MFG Co. Ltd. (4)

Ohtsu Tire And Rubber Co. Ltd. (4)

Kumho Tire Co. Inc. (3)

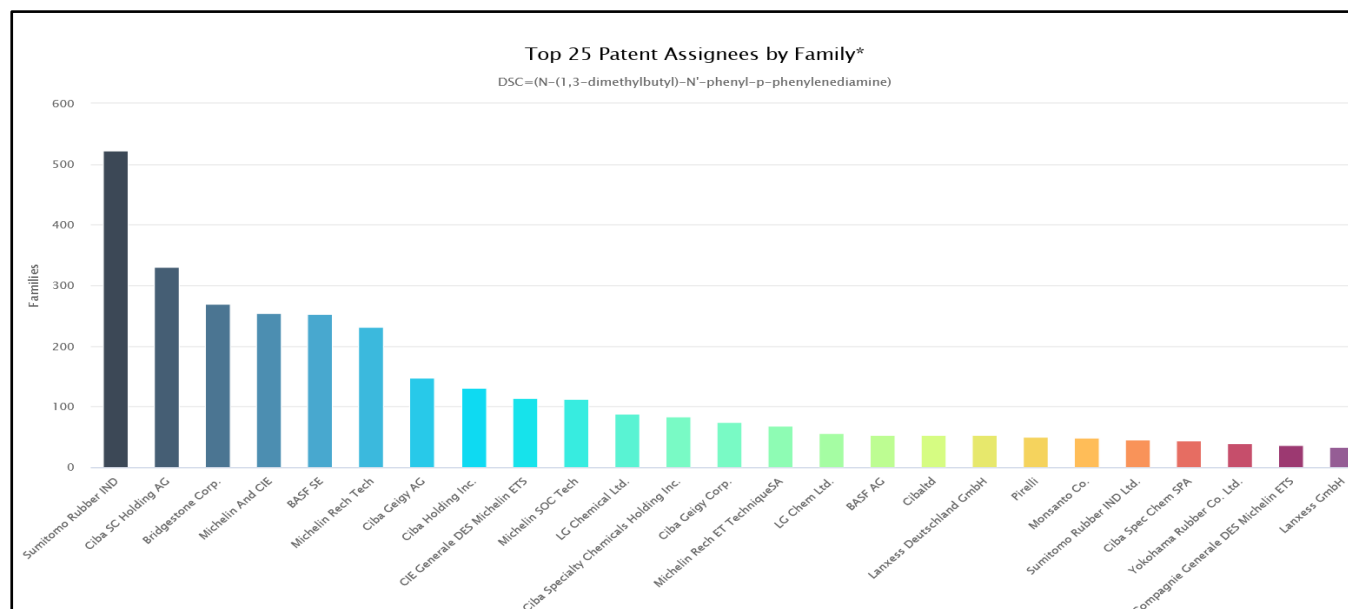
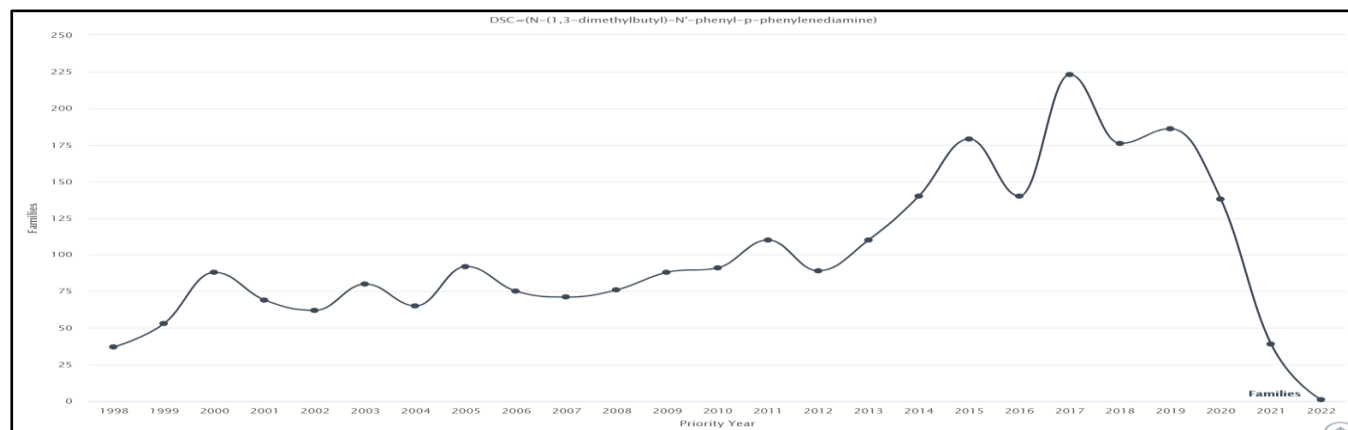
Shandong Linglong Tyre Co. Ltd. (3)

Top- Down Keywords



N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine

2867 Families



Patent Assignee	Families
Sumitomo Rubber IND	522
Ciba SC Holding AG	331
Bridgestone Corp.	269
Michelin And CIE	254
BASF SE	253
Michelin Rech Tech	231
Ciba Geigy AG	148
Ciba Holding Inc.	131
CIE Generale DES Michelin ETS	114
Michelin SOC Tech	112
LG Chemical Ltd.	88
Ciba Specialty Chemicals Holding Inc.	84
Ciba Geigy Corp.	74
Michelin Rech ET TechniqueSA	69
LG Chem Ltd.	57
BASF AG	54
Cibaltd	54
Lanxess Deutschland GmbH	54
Pirelli	50
Monsanto Co.	48
Sumitomo Rubber IND Ltd.	46
Ciba Spec Chem SPA	44
Yokohama Rubber Co. Ltd.	40

...and “tread”

...and “ozone”

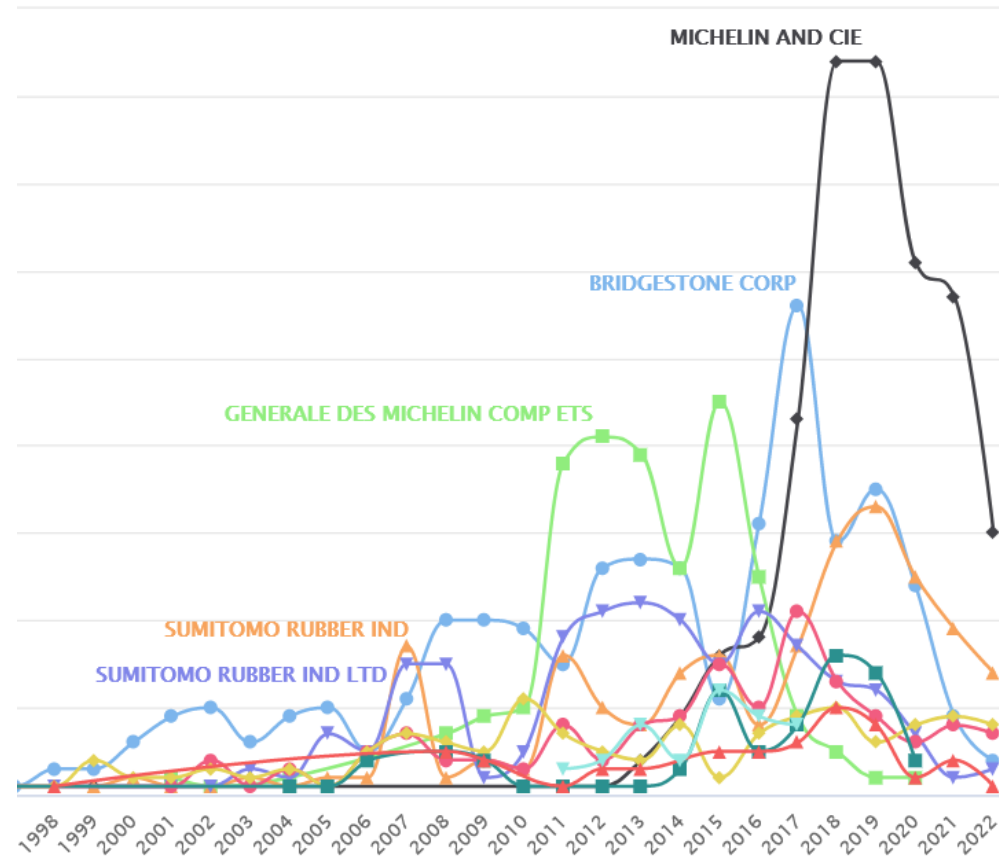
☐	BASF SE (115)
☐	Bridgestone Corp. (109)
☐	Sumitomo Rubber IND Ltd. (107)
☐	Michelin And CIE (102)
☐	Generale DES Michelin Comp ETS (77)
☐	Sumitomo Rubber IND (73)
☐	Goodyear Co. (58)
☐	Zeon Corp. (53)
☐	Mitsui Chemicals Inc. (44)
☐	Arlanxeo Deutschland GmbH (38)

..... And Toxic*

1506 Families

...

496 Families



45 Families

Review of Hits

1. Derivatives of PPD

a. oxyalkylated carbonyl Salts	Pirelli	10 759 227	Active	
b. Stearyl	Flexsys BV	US 6 444 759		Expired
c. quinone diamine	Flexsys BV	US 5 959 126		Expired
d. mono-oxalate *	Uniroyal	US 2 632 770		Expired
e. thiomethyl sub.	BASF	US 7 799 951		Expired
2. Coupling with diol	Flexsys	10 160 718	Active	
3. Coupling with carbonyls	Si Group	US 6,706,216		Expired
4. Aldehyde condensates	Toto Ltd	5 280 071		Expired
5. hydroxylated or quinonimine	Michelin	WO2022146441	Pending	

* **purported reduced toxicity (1952)**

Review of Hits cont.

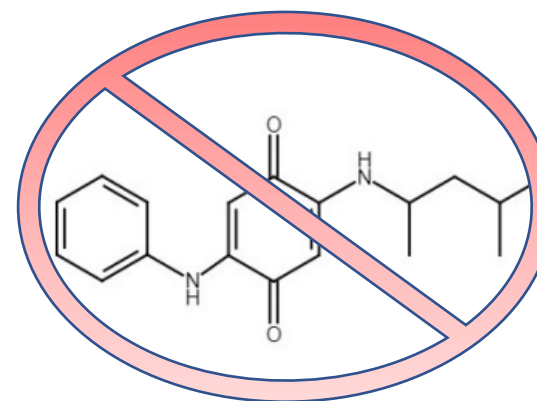
Increased efficiency / permanence / synergism / non-PPD compounds

1. Blends of PPD species	Bridgestone	2022/0243041 A1	Pending
2. Synergistic blends	Univ. Oil	FR2105563	Expired
3. Synergist blends			
1. 6-PPD and para-di(nitroso)benzene	Bridgestone	US 4 568 711	Expired
4. 6-anilino-2,2,4-trimethyl-1,2-dihydroquinoline or 6-anilino-2,2,4-trimethyl-1,2,3,4-tetrahydroquinoline	BFGoodrich	US 3 362 930	Expired
5. Slower migration and no PPD quinone forms	Michelin	WO2022146441	Pending
6. para-phenylenediamine + dihydroquinoline	Continental	US2022259413	Pending
7. Methylene acceptor / donor in-situ	Michelin	US 9 708 459	Active
8. Phosphnitrilic antiozonants	Firestone	US 3 474 052	Expired

WO22146441

Title: RUBBER COMPOSITION WITH LONGER LASTING ANTIOZONATION

Assignee: Michelin & Cie



Published in: [Family Explorer](#)

Country	Publication number	Publication date	Application number	Application date	Description
WIPO (P.C.T.)	WO22146441 A1	Jul 7, 2022	WO2020US67658	Dec 31, 2020	Publication of internationa...

Owner(s) / Assignee(s): MICHELIN AND CIE; GENERALE DES MICHELIN COMP ETS

Inventor(s): ARNOLD JESSE J; SALIT ANNE FREDERIQUE; YANG XIAOFENG SHAW

Priority: WO2020US67658 20201231

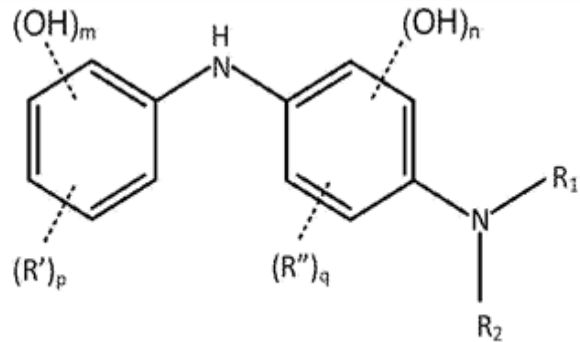
Classifications: International (IPC) C08K5/18 C09C1/44 C09C1/56 (Core/Invention)
 Cooperative (CPC) B60C1/00 B60C1/0025 B60C2001/005 C01P2002/86 C01P2006/12 C08K3/04 C08K3/06 C08K5/18 C09C1/44 C09C1/46 C09C1/56

Cited documents: WO17112440 A1, WO07042418 A2, US8101679 BB, US2015252167 AA, US2015031810 AA,

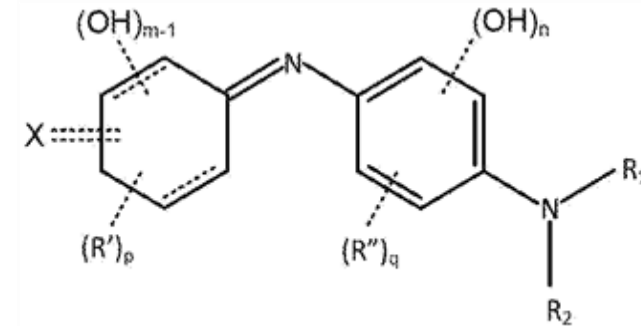
Michelin

WO2022146441

- Abstract: A rubber composition having improved antiozonation performance
- substituted hydroxyl-phenyl-p-(hydroxy)phenylenediamine.
- long lasting antiozonation performance, slowing migration through the rubber article
- reducing effluence of the antiozonant.
- continuous and intermittent dynamic operation conditions and require protection from ozonation.



(I)

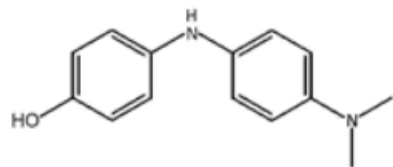


(II)

Examples WO2022146441

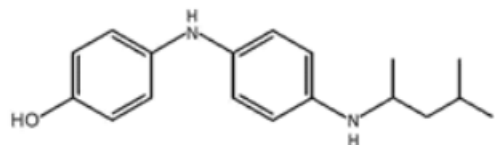
Group I hydroxyl substitution

4-((4-(dimethylamino)phenyl)amino)phenol (I-a);



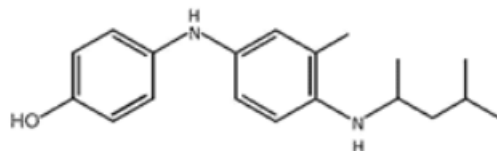
(I-a)

4-((4-((4-methylpentan-2-yl)amino)phenyl)amino)phenol (I-b);



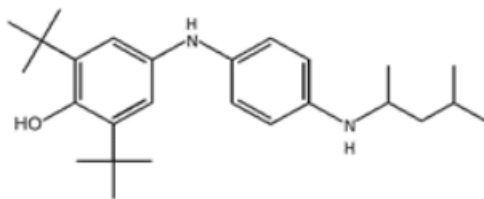
(I-b)

4-((3-methyl-4-((4-methylpentan-2-yl)amino)phenyl)amino)phenol (I-c);

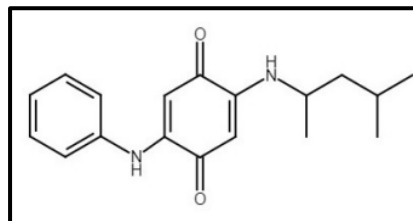


(I-c)

2,6-di-tert-butyl-4-((4-((4-methylpentan-2-yl)amino)phenyl)amino)phenol (I-d);

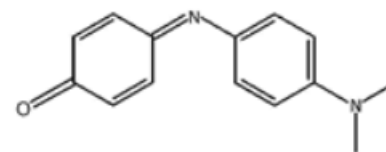


(I-d)



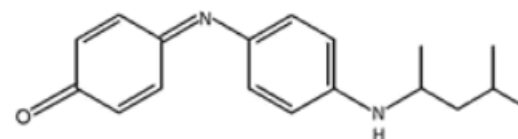
Group II quinoneimines

4-((4-(dimethylamino)phenyl)imino)cyclohexa-2,5-dienone;



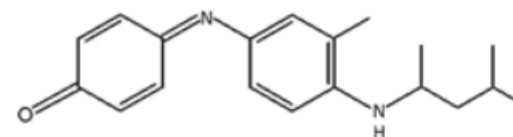
(II-a)

4-((4-((4-methylpentan-2-yl)amino)phenyl)imino)cyclohexa-2,5-dien-1-one;



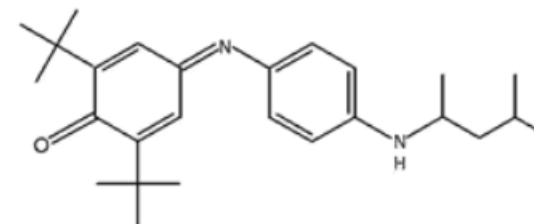
(II-b)

4-((3-methyl-4-((4-methylpentan-2-yl)amino)phenyl)imino)cyclohexa-2,5-dien-1-one;



(II-c)

2,6-di-tert-butyl-4-((4-((4-methylpentan-2-yl)amino)phenyl)imino)cyclohexa-2,5-dien-1-one ;



(II-d)

Summarizing

- Powerful Web-based tools to filter IP landscapes
- Combination of search approaches
- Review forms Insight
 - History of problem-solutions;
 - New problem-solutions emerging;
 - Follow Hits forward to present;
 - Freedom to practice
- Moving the frontier:
 - It takes a team

Thank you



Miles Dearth, Esq.

- 30+ years in the chemical and polymer industries including mfg., commercial development and IP legal roles;
- BFGoodrich, Clariant, Parker Lord, and Celanese
- BS/BA (BioPhysics/Organic Chemistry) The Ohio State Univ.
- MBA-Marketing The Ohio State Univ.
- J.D. Cleveland State University;
- Registered USPTO.
- Miles.dearth@ace-laboratories.com

