Wako

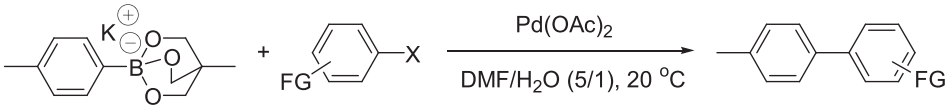
Cyclic Triolborate

Suzuki-Miyaura coupling reaction is carried out typically in the presence of a base and often in the coexistence of water as many boronic acids convert to cyclic anhydrides by dehydrotrimerization. However, since some boronic acids are hydrolyzed in basic aqueous solution, a large excess of boronic acids are often required.

Organic cyclid-triolborate salts are the ate complexed borate reagents developed by Miyaura, *et al*. There is no need to add bases in cross coupling reactions catalyzed by palladium. They may be used in aqueous and nonaqueous systems. They are also useful in *N*-arylation reaction with copper catalysts.

Reactions:

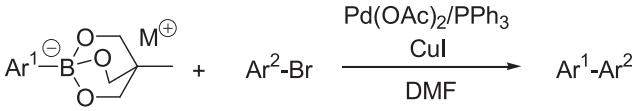
Suzuki-Miyaura Cross Coupling Reactions with Triolborate

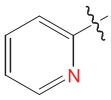
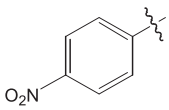
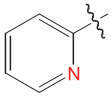
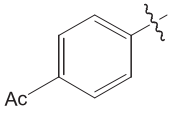
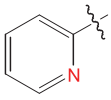
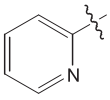
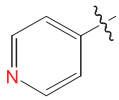
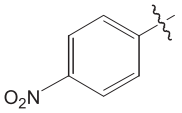
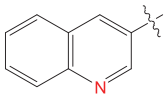
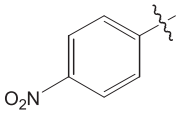


X	FG	t[h]	Yield[%]
Br	4-NO_2	5	99
Br	4-COMe	5	99
Br	4-CO_2Me	5	99
Br	4-Cl	5	99
Br	2-MeO	5	98
Br	4-MeO	5	97
OTf	4-MeO	22	89
Br	4-NMe_2	22	92

Angew. Chem. Int. Ed., **47**, 928-931 (2008).

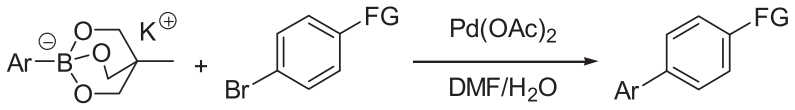
Suzuki-Miyaura Cross Coupling Reactions using heterocyclic triolborates

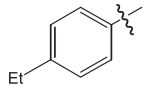
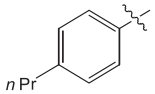
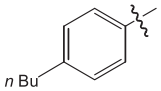
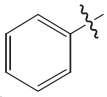
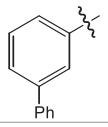
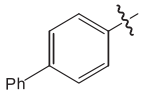
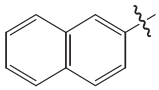
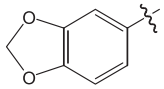
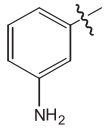


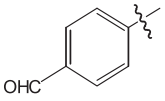
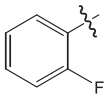
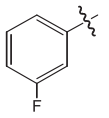
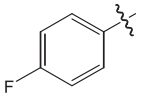
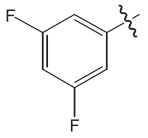
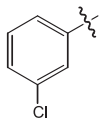
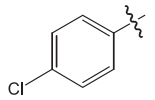
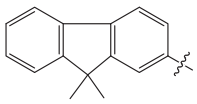
Ar^1	Ar^2	M	t[h]/T[°C]	Yield[%]
		Li	22/80	90[1)]
		Li	22/80	75[1)]
		Li	22/80	70[1)]
		Na	10/100	86
		K	10/100	88

1) *Angew. Chem. Int. Ed.*, **47**, 928-931 (2008).

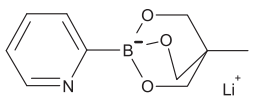
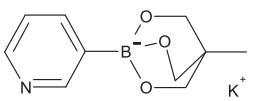
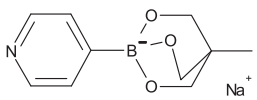
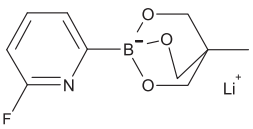
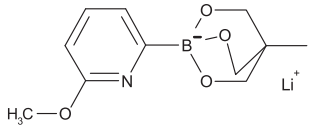
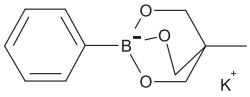
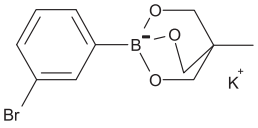
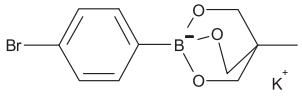
Suzuki-Miyaura Cross Coupling Reactions using various cyclic triolborates



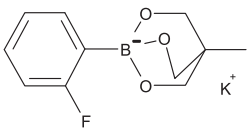
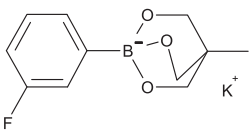
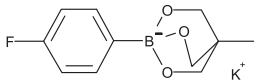
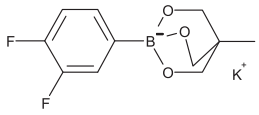
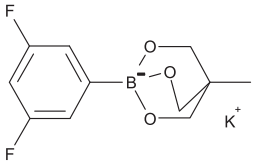
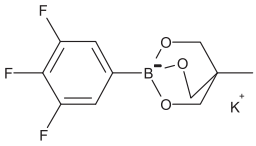
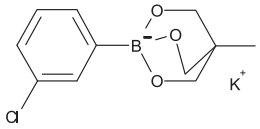
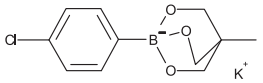
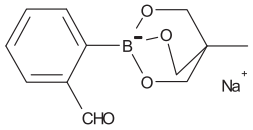
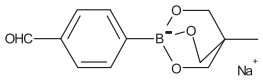
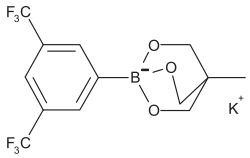
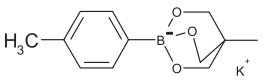
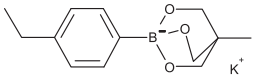
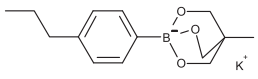
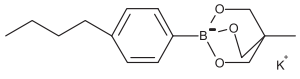
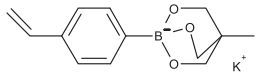
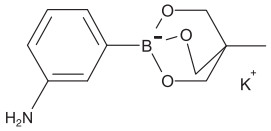
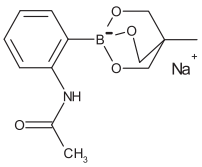
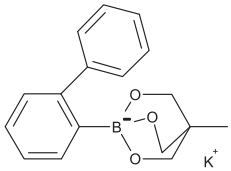
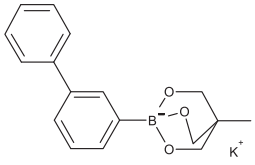
Ar	FG	t[h]/T[°C]	Yield(%)
	MeO	3/rt.	quant.
	MeO	4/rt.	99
	MeO	5/rt.	94
	MeO	5/rt.	92
	MeO	5/rt.	quant.
	MeO	6/rt.	99
	MeO	5/rt.	95
	MeO	5/rt.	quant.
	MeO	8/rt.	quant.

Ar	FG	t[h]/T[°C]	Yield(%)
	NO_2	10/80	99
	MeO	7/rt.	95
	MeO	5/rt.	98
	MeO	5/rt.	quant.
	MeO	5/rt.	quant.
	MeO	5/rt.	98
	MeO	5/rt.	98
	NO_2	5/100	98

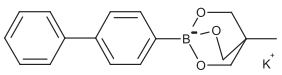
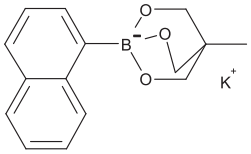
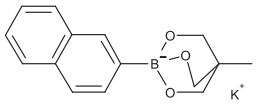
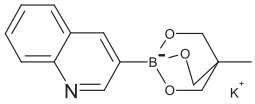
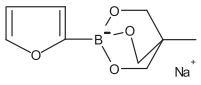
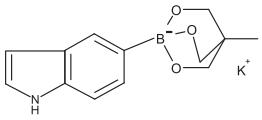
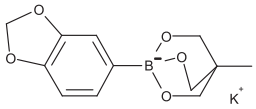
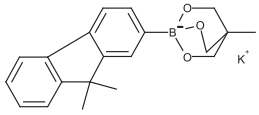
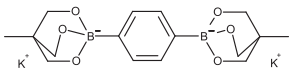
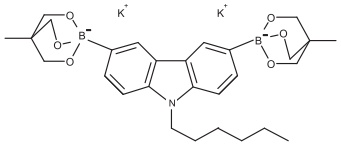
Product List

(2-Pyridine)cyclic-triolborate Lithium Salt  163-23761 1g 169-23763 5g	(3-Pyridine)cyclic-triolborate Potassium Salt  160-23771 1g 166-23773 5g	(4-Pyridine)cyclic-triolborate Sodium Salt  167-23781 1g 163-23783 5g	2-(6-Fluoropyridine)cyclic-triolborate Lithium Salt  060-05621 1g 066-05623 5g
2-(6-Methoxypyridine)cyclic-triolborate Lithium Salt  137-16311 1g 133-16313 5g	Phenylcyclic-triolborate Potassium Salt  [1014716-89-2] 166-24111 1g 162-24113 5g	(3-Bromophenyl)cyclic-triolborate Potassium Salt  024-16551 1g 020-16553 5g	(4-Bromophenyl)cyclic-triolborate Potassium Salt  028-16571 1g 024-16573 5g

Product List *(continued)*

(2-Fluorophenyl)cyclic-triolborate Potassium Salt  064-05521 1g 060-05523 5g	(3-Fluorophenyl)cyclic-triolborate Potassium Salt  061-05531 1g 067-05533 5g	(4-Fluorophenyl)cyclic-triolborate Potassium Salt  068-05541 1g 064-05543 5g	(3,4-Difluorophenyl)cyclic-triolborate Potassium Salt  041-30841 1g 047-30843 5g
(3,5-Difluorophenyl)cyclic-triolborate Potassium Salt  048-30851 1g 044-30853 5g	(3,4,5-Trifluorophenyl)cyclic-triolborate Potassium Salt  201-17481 1g 207-17483 5g	(3-Chlorophenyl)cyclic-triolborate Potassium Salt  032-21281 1g 038-21283 5g	(4-Chlorophenyl)cyclic-triolborate Potassium Salt  039-21291 1g 035-21293 5g
(2-Formylphenyl)cyclic-triolborate Sodium Salt  065-05291 1g 061-05293 5g	(4-Formylphenyl)cyclic-triolborate Sodium Salt  068-05301 1g 064-05303 5g	[3,5-Bis(trifluoromethyl)phenyl]cyclic-triolborate Sodium Salt  021-16681 1g 027-16683 5g	(4-Methylphenyl)cyclic-triolborate Potassium Salt  134-16061 1g 130-16063 5g
(4-Ethylphenyl)cyclic-triolborate Potassium Salt  056-07861 1g 052-07863 5g	(4-Propylphenyl)cyclic-triolborate Potassium Salt  160-24011 1g 166-24013 5g	(4-*n*-Butylphenyl)cyclic-triolborate Potassium Salt  021-16561 1g	(4-Vinylphenyl)cyclic-triolborate Potassium Salt  224-01841 1g 220-01843 5g
(3-Aminophenyl)cyclic-triolborate Potassium Salt  015-22891 1g 011-22893 5g	(2-Acetamidophenyl)cyclic-triolborate Sodium Salt  019-23031 1g 015-23033 5g		
(2-Biphenyl)cyclic-triolborate Potassium Salt  021-16321 1g 027-16323 5g	(3-Biphenyl)cyclic-triolborate Potassium Salt  026-16511 1g 022-16513 5g		

Product List *(continued)*

(4-Biphenyl)cyclic-triolborate Potassium Salt  023-16521 1g 029-16523 5g	(1-Naphthalene)cyclic-triolborate Potassium Salt  140-08771 1g 146-08773 5g	(2-Naphthalene)cyclic-triolborate Potassium Salt  144-08791 1g 140-08793 5g	(3-Quinoline)cyclic-triolborate Potassium Salt  175-00681 1g 171-00683 5g
(2-Furan)cyclic-triolborate Sodium Salt  063-05611 1g 069-05613 5g	(5-Indole)cyclic-triolborate Potassium Salt  099-05851 1g 095-05853 5g	[(3,4-Methylenedioxy)phenyl]cyclic-triolborate Potassium Salt  136-16141 1g 132-16143 5g	2-(9,9-Dimethylfluorene)cyclic-triolborate Potassium Salt  042-31091 1g 048-31093 5g
(*p*-Phenylene)dicyclic-triolborate Dipotassium Salt  165-24201 1g 161-24203 5g	[3,6-(9-Hexylcarbazole)]dicyclic-triolborate Dipotassium Salt  080-09121 1g 086-09123 5g		

Besides above products, Wako provides over 30 kinds of cyclic triolborates. Search the website www.e-reagent.com using "triolborate" as a keyword. Please feel free to contact us if you want to order other package sizes.

Wako Pure Chemical Industries, Ltd.
www.wako-chem.co.jp
Osaka, Japan
Tel: 81-6-6203-3741/
Fax: 81-6-6201-1999
Online Catalog: www.e-reagent.com

Wako Chemicals USA, Inc.
www.wakousa.com
Toll-Free (U.S. only): 1-877-714-1920
Head Office (Richmond, VA):
Tel: 1-804-714-1920/ Fax: 1-804-271-7791
Los Angeles Sales Office (Irvine, CA):
Tel: 1-949-679-1700/ Fax: 1-949-679-1701
Boston Sale Office (Cambridge, MA):
Tel: 1-617-354-6773/ Fax: 1-617-354-6774

Wako Chemicals GmbH
www.wako-chemicals.de
Neuss, Germany
Tel: 49-2131-311-0/
Fax: 49-2131-311100